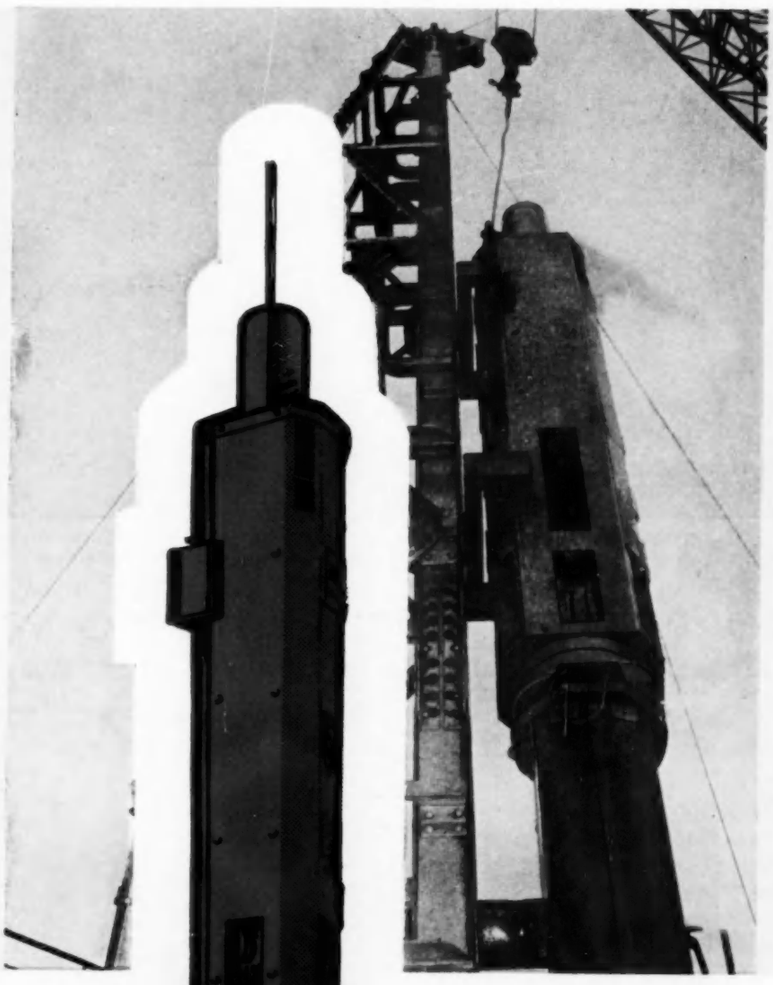
THE ENGINEER

DECEMBER 2, 1960 | 28 ESSEX STREET, STRAND, LONDON, W.C.2 | TWO SHILLINGS



McKIERNAN -TERRY DIESEL PILE HAMMERS FOR *POWER, ECONOMY AND RELIABILITY*

McKiernan-Terry DE-30 diesel pile hammer in false leaders driving a steel box pile

McKiernan-Terry Diesel Pile Hammers are designed for reliability, combined with economy in both operation and maintenance. They are completely self-contained and need no external source of power other than a winch to lift the hammer and to raise the ram-piston for starting.

Fuel and lubricating oil consumptions are low and the built-in tanks hold sufficient fuel and oil for two to three days normal operation. All parts are readily accessible for inspection or maintenance. Ruggedly built from high quality materials and components, including special alloy steel parts, and manufactured to close tolerances and fine finishes, the McKiernan-Terry range of Diesel Pile Hammers provide a most economical and reliable means of driving piles of all types.

For full details write for List No. 190/K

BSP

TECHNICAL REPRESENTATIVES THROUGHOUT THE WORLD

THE BRITISH STEEL PILING CO. LTD.

10 HAYMARKET, LONDON, S.W.1. *Telephone: TRAfalgar 1024*

Enter No. C1 on reply card

The Roselend Dam will control the waters flowing into the Roselend valley from the Beaufort massif. Other streams will also be diverted into the catchment area by means of some 60 km of collector tunnels (with diameters of between five and nine metres). A second dam at Chapelle de St. Guerin will control the waters of the Poncellamont Gorge. Illustrated above is an artist's impression of the Roselend Dam.

FRANCE PUTS THE SAVOY ALPS TO WORK

Atlas Copco and Sandvik Coromant equipment used extensively at Roselend

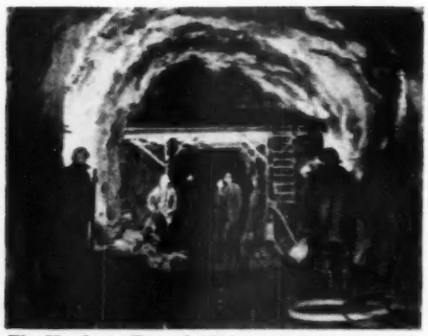
TO THE TOURIST, the Savoy Alps may conjure up visions of winter sports or long, lazy summer holidays, but to Electricité de France the region means power! The French State power board is building a series of storage reservoirs in the upper Isere area of the Alps, not far from the Italian border. The most important part of the scheme is the Roselend Valley section which will increase France's power reserve by 1,000 million kW a year. This project involves building two dams and a 476,000 kW power station at Bathie which will be the most powerful in France.

Atlas Copco compressed air equipment is being used almost everywhere on this project. For drilling the main tunnels more than a hundred BBD41WK rock drills with pusher feeds and several thousand Sandvik Coromant drill steels are being used by the main contractors, Borie, Ets. Sinrapt & Brice, Gebro, Pegas & Pugeat, Stribick Et Fils.

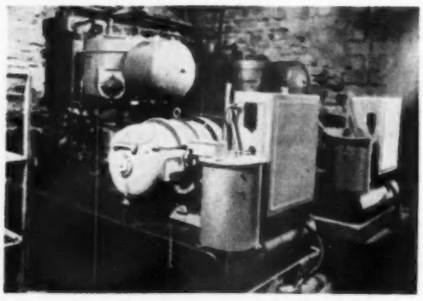
Sales and Service in ninety countries

Atlas Copco is the world's largest organisation specialising solely in compressed air equipment. Products include stationary and portable compressors, rock drills, loaders and air tools and equipment of every description. Wherever you are, the international Atlas Copco group will supply expert advice on the selection of equipment and provide a complete after-sales service.

General view of work on the Roselend Dam.



The Headrace Tunnel will be 13 km in length and 4.2 metres in diameter. Single deck platforms are used for drilling, with four men working on the platform and four on the ground beneath.



Two Atlas Copco AR3L compressors supply the air power at the Versoyen drilling site.

Atlas Copco puts compressed air to work for the world

ATLAS COPCO AB, STOCKHOLM 1, SWEDEN

Enter No. C2 on reply card

DSA.1

THE ENGINEER

Established 1856

No. 5471 DECEMBER 2, 1960 VOL. 210

EDITORIAL CONTENTS

Leading Articles

The Two Aswan Schemes . . . 919
Mechanicals Get No Rate Relief . . . 919
T.S.S. "Oriana" . . . 920
Report on Data Processing . . . 920
How to Save Money by Saving Water . . . 921

Articles

100 Years Ago . . . 921
Industrial Value of D.S.I.R. Research. No. II (Part II) . . . 922
Diesel Locomotives in the United States . . . 926
Agricultural Machinery at Earls Court. No. I . . . 929
Roundabouts and Traffic Signals . . . 930
Ross Motorway . . . 932
Poly-Propylene in Production . . . 933
Sizewell Nuclear Power Station . . . 936
Experimental Electronic Telephone Exchange System . . . 938
Low-Distortion Transistor Oscillator . . . 939
Screw Design Air Compressor . . . 940
Anglo-American Summer School on Industrial Archaeology . . . 941
Reverse-Cycle Refrigeration. Surface Finish Measurement . . . 941
Radial Drilling and Tapping Machine . . . 942
Pinch Pyramid Plate Bending Rolls. Non-Consumable Anode Hooks . . . 942
Flat-Rising Jet V.T.O.L. Mains-Failure Generator Control Panel . . . 943
Composite Construction Using High-Tensile Steel "H"-Beams . . . 944
Hydraulic Drive for Mine Conveyors . . . 944
Billet Handling Equipment for Rotary Hearth Furnace . . . 945
A.C. Drives for Two Bascule Bridges . . . 945
Vapour-Cooled Valves for Industrial Heaters . . . 946
Variable-Speed Aggregate Blender. Compressed Air Filters . . . 946
Articulated Dump Truck . . . 947
"Ladder" Drilling for Rock Tunnelling. Pneumatic Sawing or Filing Tool . . . 947
Ratchet Piston Clamp. Automatic X-Ray Spectrometer. 7½ Cubic Yard Dumper . 948

Mainly Metallurgy

Corrosiveness of Indoor Atmospheres . . . 935
First International Congress on Metallic Corrosion: London, 1961 . . . 935
"The Metallurgy of Beryllium" International Conference, 1961 . . . 935

Continental Affairs

Grande Dixence Scheme. Second Reactor for Karlsruhe . . . 951
Heavy Locomotive for Ore Line. Contact Resistance of Metal Sheet . . . 952
Self-Supporting Plastic Cylinder for Television Aerial . . . 952

American Scene

The General Electric Strike . . . 953
Machine Tool Exposition and Production Engineering Show at Chicago. No. V . . . 954
Gallium Phosphide Single Crystals . . . 955
Plutonium Rolling Mill Installation . . . 956
Continuous Casting Plant for Australia . . . 956

LETTERS Thousands of Millions of Pounds to be Saved ? . . . 934

BOOK REVIEWS . . . 934

OBITUARY Sir John Edward Thornycroft, K.B.E. . . . 931

NEWS AND NOTES
Technical Reports . . . 928
Launches and Trial Trips . . . 948
Industrial News . . . 949
Personal and Business . . . 950
British Patent Specifications . . . 957
Forthcoming Engagements . . . 958

INDEX TO ADVERTISERS : PAGE 135 **CLASSIFIED ADVERTISEMENTS : PAGE 125**

NOTICE TO READERS No undertaking can be given to return illustrations or manuscripts. Correspondents are requested to keep copies. No notice is taken of anonymous communications.

SUBSCRIPTIONS U.K. and ABROAD £5 10. 0. p.a., including postage (CANADA £5 5. 0.). Single copies 2s. each, plus 9d. postage. Also on sale at newsagents.

'THE ENGINEER' BUYERS GUIDE Published annually. One FREE copy is sent to all direct postal subscribers on publication and delivered by newsagents to all regular readers. Additional copies are obtainable at 7s. 6d. each. Postage 1s. 9d. extra.

Published every Friday by

MORGAN BROTHERS (PUBLISHERS) LTD., AT 28, ESSEX STREET, STRAND, LONDON, W.C.2. Telephone : CENtral 6565

MARS-LUMOGRAPH

DRAWING AND BLUE-PRINT PENCILS

are specially produced to meet the needs of architects, draughtsmen, and others who require pencils of the highest quality.

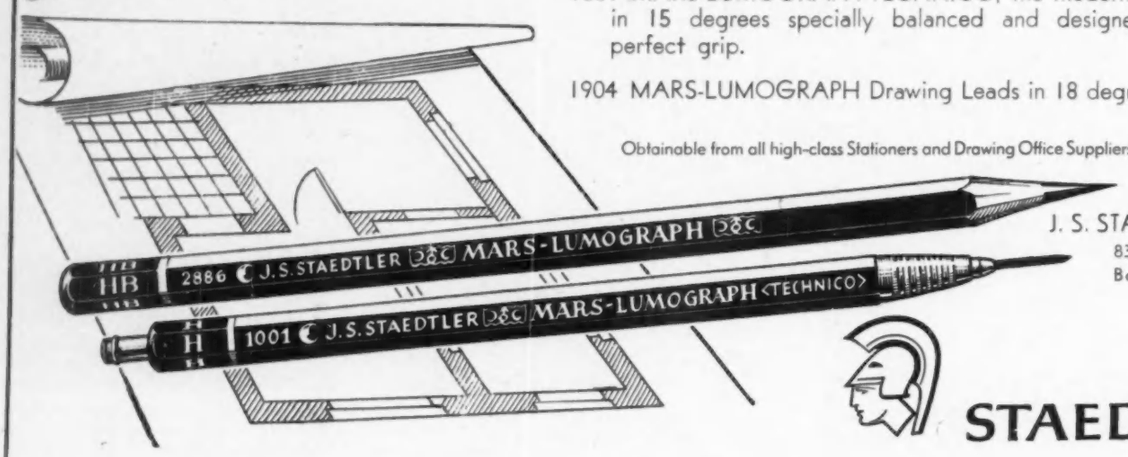
They give a clear black line, not easily smudged, and are specially treated with a patent substance that gives perfect blue-prints

2886 MARS-LUMOGRAPH, cedar wood pencils available in 19 different degrees.

1001 MARS-LUMOGRAPH-TECHNICO, the modern clutch pencil, in 15 degrees specially balanced and designed to give a perfect grip.

1904 MARS-LUMOGRAPH Drawing Leads in 18 degrees.

Obtainable from all high-class Stationers and Drawing Office Suppliers. Trade enquiries to-



J. S. STAEDTLER, Ltd.,
83 Copers Cope Road,
Beckenham, Kent.

STAEDTLER

7464

Enter No. 21 on reply card

MUSCLE is the most costly power on earth

How much are YOU wasting on the man-handling of YOUR products?

ACROW DEMAG BANTAM

–the world's best 5 cwt. Electric Hoist

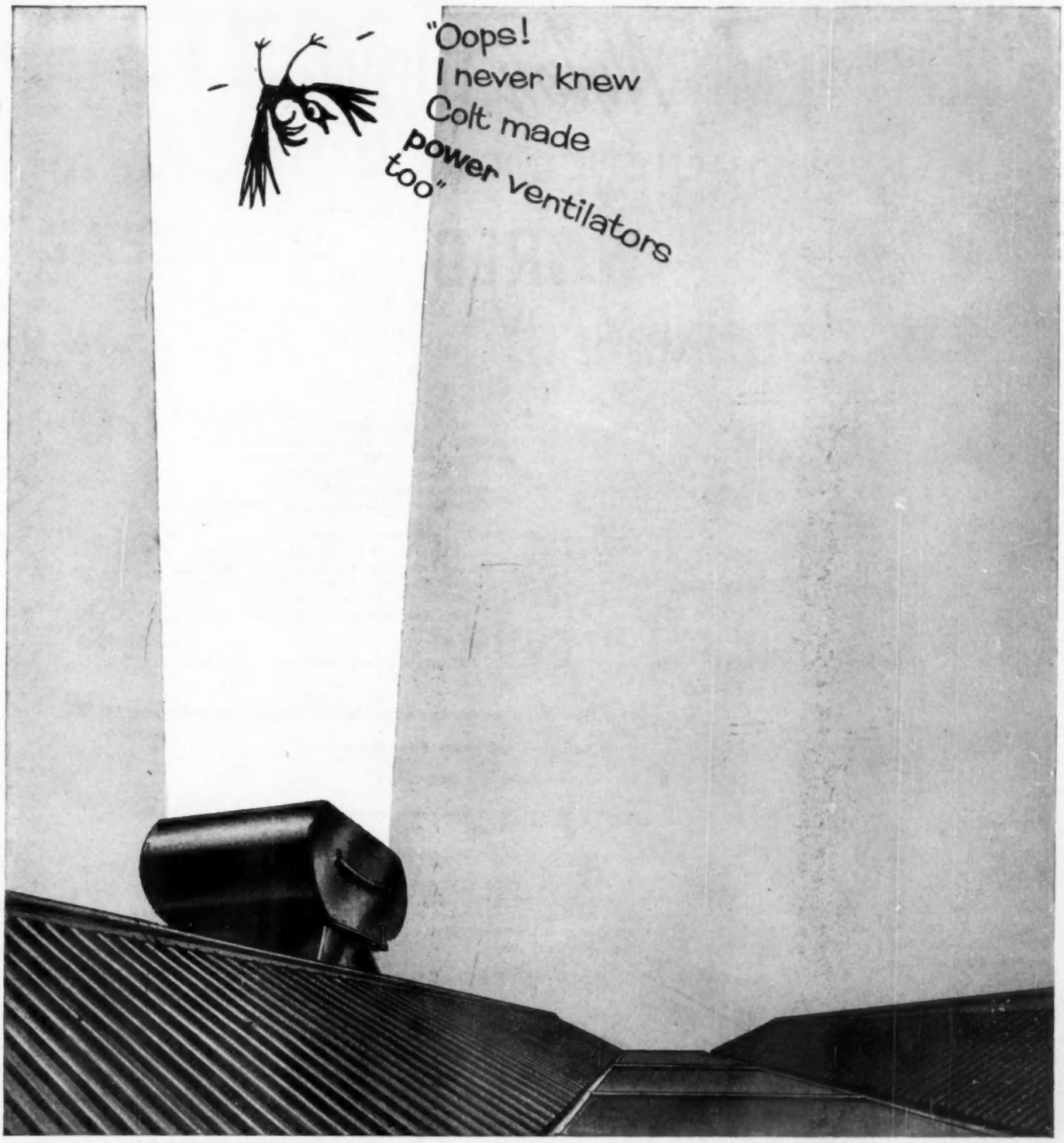
Guaranteed by DEMAG-ZUG, WETTER, the world's largest hoist makers

COSTS ONLY **£68** *including push-button Control-handle & Chain-collector*

Take your first step NOW towards eliminating waste of labour. Send for full details to:–

Sole U.K. Agents: **ACROW (ENGINEERS) LTD., DEMAG DIVN.,**
South Wharf, London, W.2. Telephone: AMBassador 3456 (20 lines)
Branches: BIRMINGHAM, BRISTOL, CARDIFF, GLASGOW, LEEDS, LIVERPOOL, MANCHESTER, NEWCASTLE, SAFFRON WALDEN, SOUTHAMPTON & BELFAST

Enter No. 22 on reply card



They do! Colt have a ventilator, natural or powered, to meet every kind of problem—including a range of high powered ventilators such as the Upward Discharge unit shown here. Let the Colt Ventilation Service advise you. Powered or natural, or a combination of both—the Colt engineer will tell you which system is best and most economical for you. Send for a manual to Dept. 37

COLT

The power behind natural ventilation and naturally behind powered ventilation too!

COLT VENTILATION LIMITED · SURBITON · SURREY · TEL: ELMBRIDGE 0161

Enter No. 31 on reply card

TECALEMIT *Nylon* TUBING ACHIEVES **WORLD** SUPREMACY

Tecalemit, pioneers of extruded nylon tubing, owe their present supremacy in this sphere to the most exacting research, testing and development in co-operation with the producers of the raw material. Tecalemit have now achieved marvellous limits of precision in extruded nylon tubing—limits unequalled and indeed unthought of previously—an exclusive technical triumph.

Flexible and rigid Tecalemit nylon tubing now outperforms metal, other plastics and rubber for industrial and automotive oil and fuel lines. Tecalemit Tubing is fitted as standard by such great names as Aston-Martin, Austin, Ford, International Harvester, Jaguar, Massey-Ferguson, Rover and many large industrial users—including, of course, Tecalemit industrial lubrication installations.

Tubes of precise inside diameter of ¼" and less have proved under test to be unharmed by

1,100 vibrations per minute at 250°F and 45 p.s.i. for 700 hours

immersion in Derv at 212°F for 200 hours

air temperatures of 1–178°C

tensile strains of 100 lb (after being dry-air aged at 212°F)

And they save up to 50% in initial cost!

Tecalemit Nylon Tubing almost halves fitting times; is free of internal abrasive scale; resists shock, even below -70°C; resists most solvents, corrosion and fungal attack; is unaffected even by strong ultra-violet light, and form-stable over a wide temperature range.

For full particulars write to:

TECALEMIT LTD. (SALES EN)
PLYMOUTH · DEVON

NEW!

TECALEMIT HIGH PRESSURE NYLON HOSE

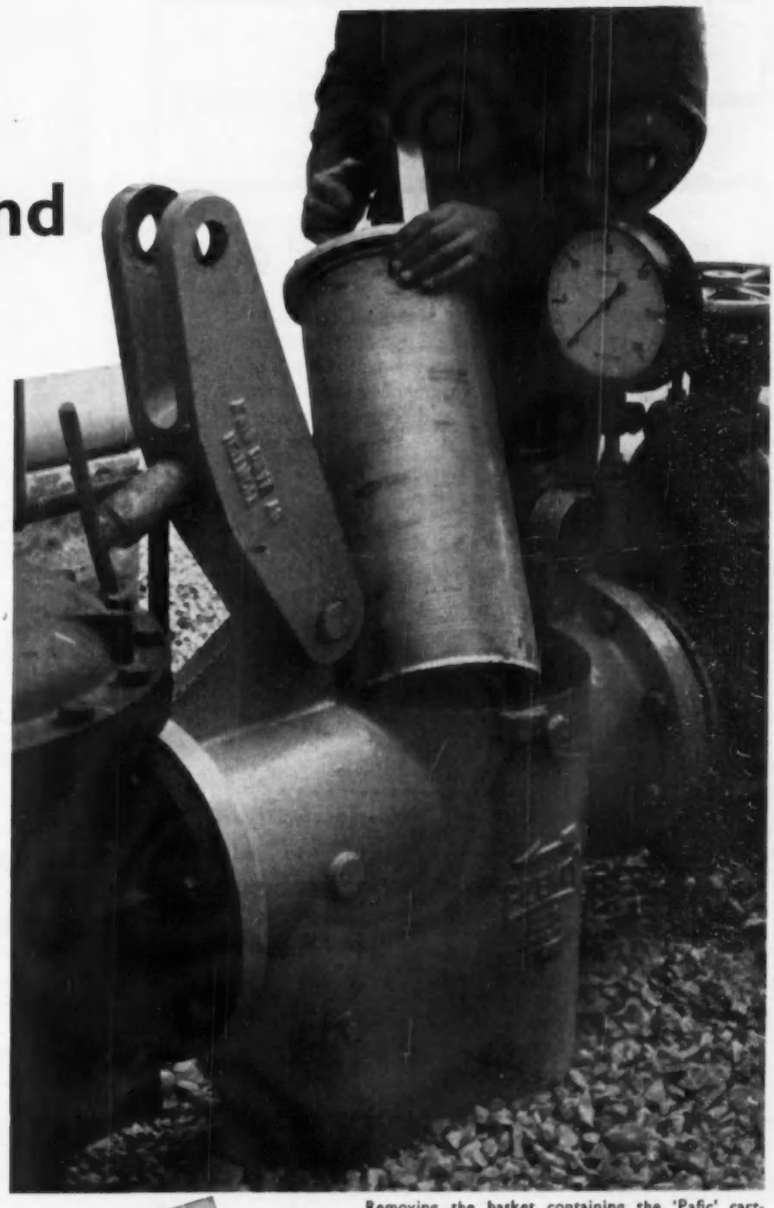
Following in the great tradition of Nylon Tubing, Tecalemit present a new High Pressure Nylon Hose. More durable, flexible, lighter, stronger and more stable than any other hose on the market. And highly competitive in price! Ask for details when enquiring about Tecalemit Nylon Tubing.

Enter No. 41 on reply card

FILTERS

for LIQUIDS and GASES

- ½ in. up to 36 in. bore
- Simplex and Duplex types
- Maximum efficiency (basket area up to 25 times that of pipe)
- No tools required for maintenance
- Simplicity of operation
- No spillage on basket and cover removal
- Remote control available
- 'PAFIC' elements for gas filtration



Removing the basket containing the 'Pafic' cartridge from an 8 inch Plenty Simplex Gas Filter at the Llandudno Gas Works, N. Wales

Write for these leaflets which give full details of Plenty Filters

PLENTY & SON Ltd.

EAGLE IRON WORKS

NEWBURY, Berks., England

TELEPHONE : NEWBURY 2363 (5 lines)
TELEGRAMS : PLENTY, NEWBURY, TELEX
TELEX : 84110

Enter No. 51 on reply card

KINNEAR SHUTTERS

by the makers of Kinylon and Kinrod Grilles

solve the problem

of wide entrances and a sloping road. The bottom rails on these Kinnear Shutters are shaped to accommodate the rise of the road, to ensure good closure and complete weather protection.

Please send for illustrated leaflet 7B

ARTHUR L. GIBSON & CO. LTD., TWICKENHAM, MIDDLESEX.

Telephone: Popesgrove 2276. *Birmingham:* Highbury 2804. *Glasgow:* Halfway 2928. *Manchester:* Central 1008. *Cardiff* 51428

7.B.

Enter No. 61 on reply card

EMERGENCY

but the STEEL-SHAW COUPLING can take it!

Here's a really **flexible** coupling. Its individual springs mean that it will accommodate alignment errors; absorb shock and stress; damp out vibrations yet allow free end-float under loads; have a resistance to shear of approximately fifteen times the working load. Yet when you come to look at sizes against torque, you'll find that this outstanding unit will be smaller in diameter than any other coupling you can buy. *Write for full details today.*

STEELE & COWLISHAW LTD.

NEARLY HALF A CENTURY'S EXPERIENCE IN MIXING

COOPER STREET · HANLEY · STOKE-ON-TRENT

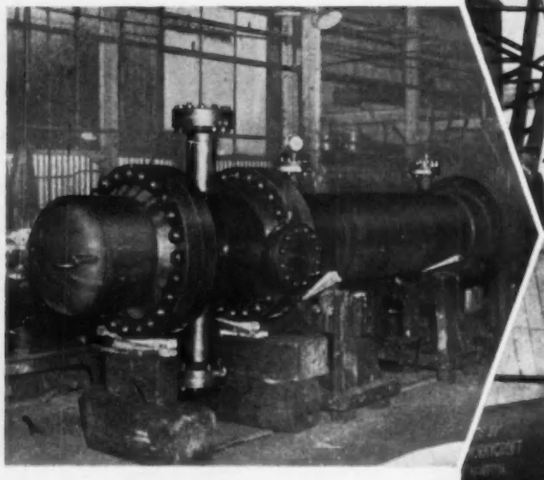
Telephone: STOKE 23333 (5 lines) TELEX 3630

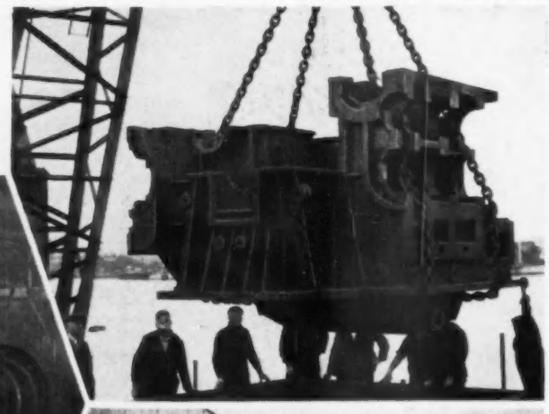
A MEMBER OF THE BAKER PERKINS GROUP

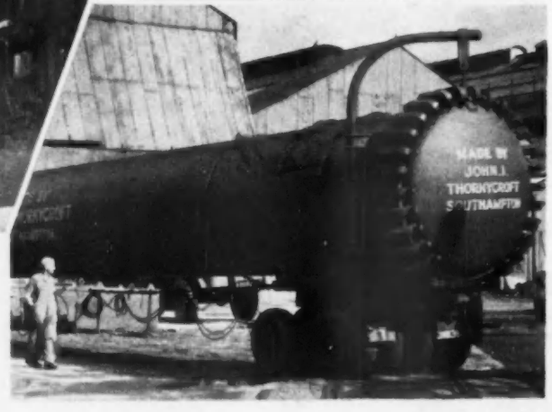
Enter No. 62 on reply card

All SHAPES and SIZES

WELDED PRESSURE VESSELS and **STEEL FABRICATIONS** can be undertaken by





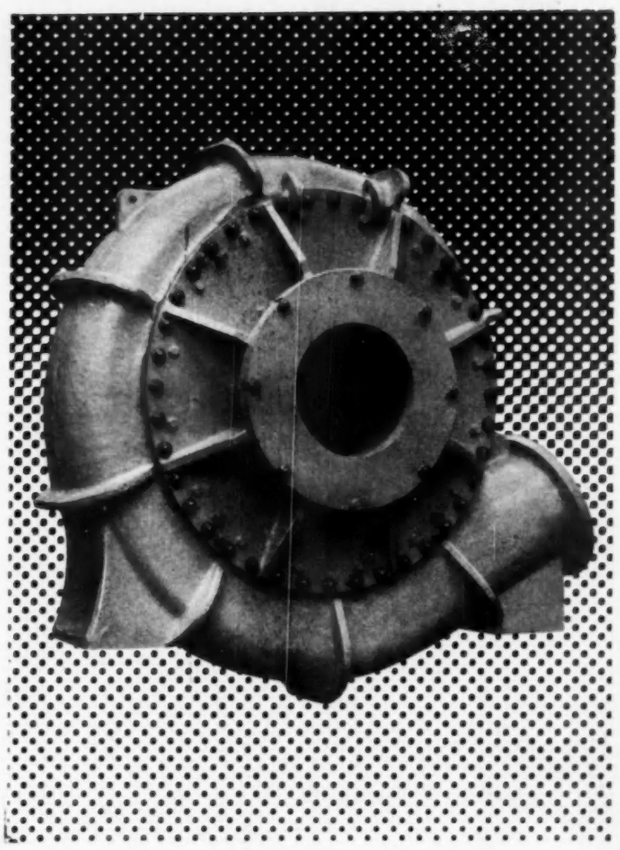


THORNYCROFT

JOHN I. THORNYCROFT & CO. LIMITED, WOOLSTON WORKS, SOUTHAMPTON

Enter No. 63 on reply card

What goes on round here?



Here is the heart of a modern suction dredge. This powerful diesel driven dredging pump, designed and built by Simons-Lobnitz, embodies the use of wear resistant alloy steel components readily accessible for rapid maintenance and specially chosen for easy resurfacing by welding. It is in daily service on the Fraser River, British Columbia, handling a large yardage of highly abrasive coarse sand.

For requirements in harbour maintenance, channel clearance, canal cutting or any other dredging problem, get in touch with Simons-Lobnitz—the world's most experienced dredge builders.

SIMONS - LOBNITZ

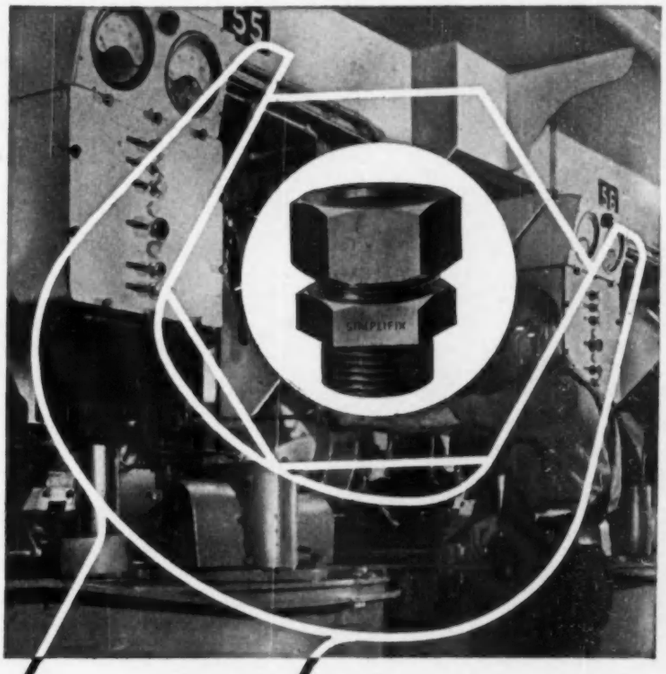
SIMONS-LOBNITZ LTD · RENFREW · SCOTLAND

CABLE ADDRESS :—SIMLOB, RENFREW
TELEPHONE :—RENFREW 3751
LONDON OFFICE:—Dunster House, 37 Mincing Lane, E.C.3

DREDGE BUILDERS TO THE WORLD

Enter No. 71 on reply card

Engineers prefer SIMPLIFIX the foolproof coupling



The illustration shows centrifugal machines at the Plaistow Wharf Sugar Refinery of Tate and Lyle Ltd., where large numbers of Simplifix couplings are used.

Simplifix—the sure and simple compression coupling for copper pipe. Perfect joints with almost all kinds of tubing, including those with very thin walls. No work to do on the pipe. Simply tighten the nut—the anti-friction washer prevents pipe twisting. Manufactured since 1930, still the best. Millions in use. Made in sizes to suit tubing from $\frac{1}{8}$" to 2" O.D., in a wide range of interchangeable standard fittings. Non-standard fittings also made to order. Let us send you the Simplifix catalogue.

SIMPLIFIX

SIMPLIFIX COUPLINGS LTD · HARGRAVE ROAD · MAIDENHEAD · BERKS
TEL: MAIDENHEAD 5100 · *A member of the ALENCO Group of Companies*

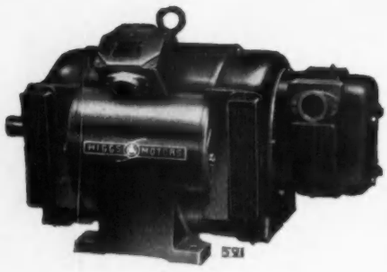
Enter No. 72 on reply card

TRADE MARK

HIGGS MOTORS LTD.

MANAGING DIRECTOR DAVID C.Y. HIGGS, A.M.I.E.E.

BIRMINGHAM 6 ENGLAND

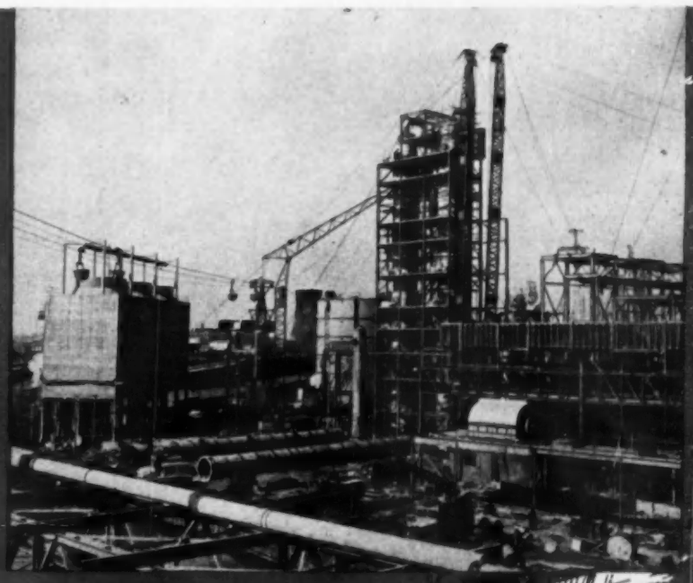


SLIP RING MOTORS up to 1000 H.P.

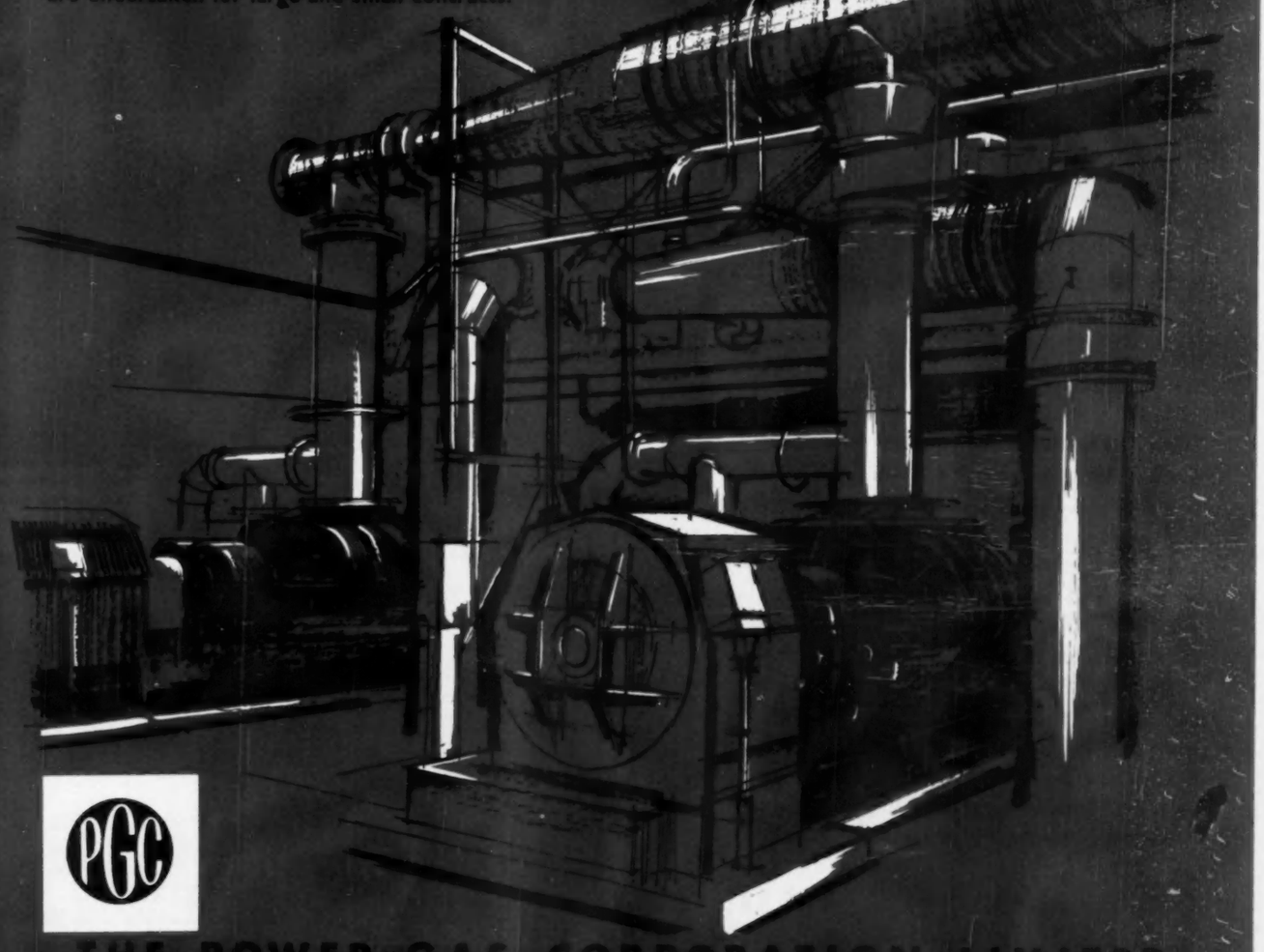
BELFAST · BRISTOL · CARDIFF · DUBLIN · DUNDEE · GLASGOW · HULL · LEEDS · LIVERPOOL · LONDON
MANCHESTER · NEWCASTLE · PETERBOROUGH · SHEFFIELD · WOLVERHAMPTON

Enter No. 81 on reply card

Project and Equipment Construction



Comprehensive field engineering services, based on many years experience, are undertaken for large and small contracts.



PGC

THE POWER-GAS CORPORATION LIMITED

STOCKTON-ON-TEES AND LONDON

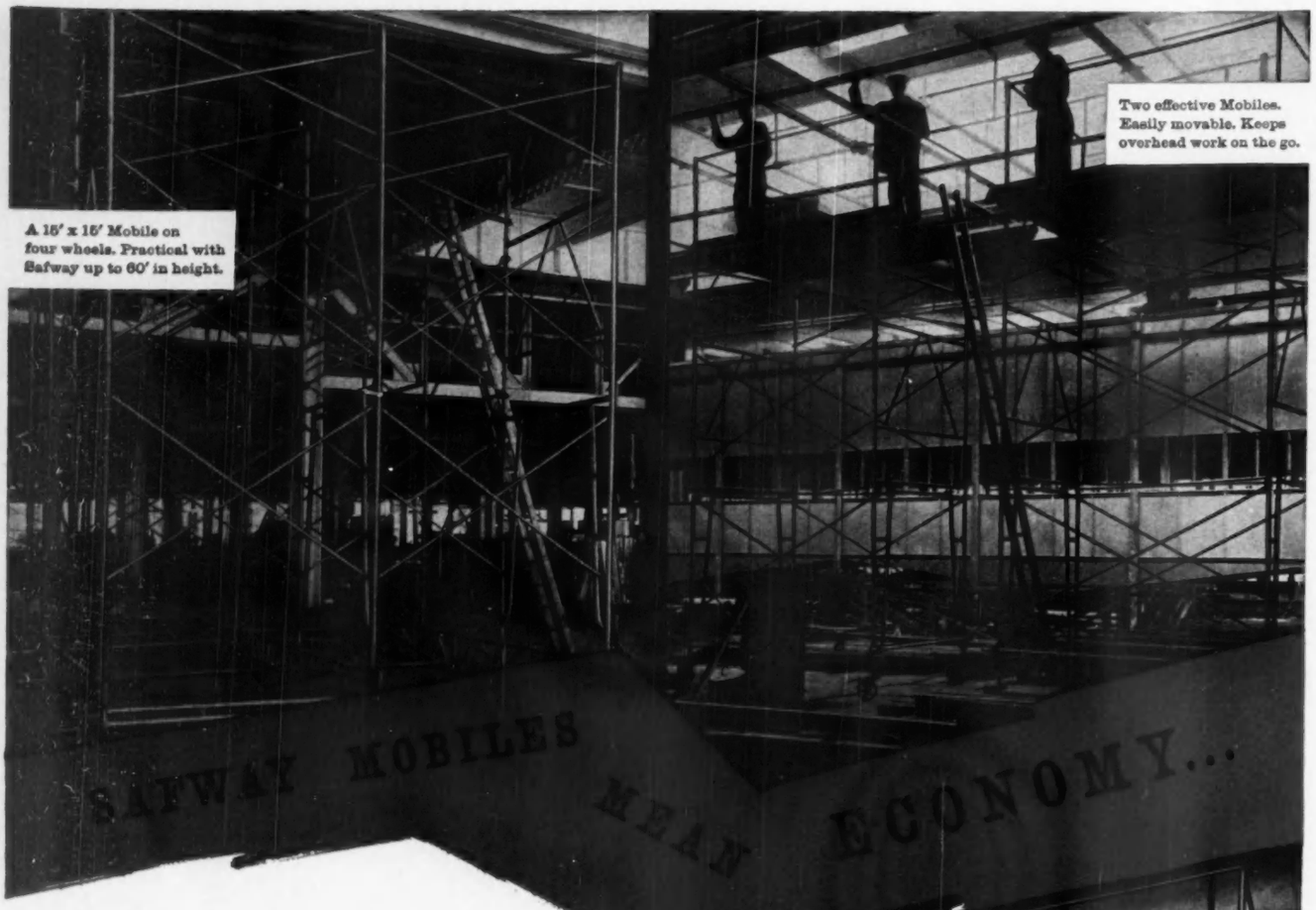
DAVY-ASHMORE GROUP

441

PARIS · MONTREAL · MELBOURNE · JOHANNESBURG · BOMBAY

Enter No. 91 on reply card

B



A 15' x 15' Mobile on four wheels. Practical with Safway up to 60' in height.

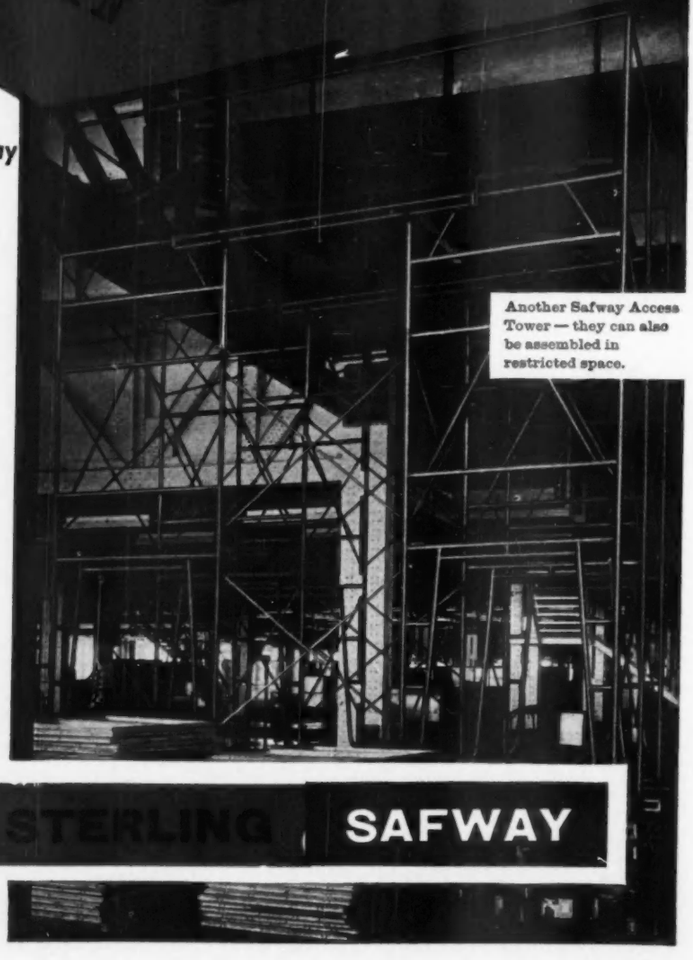
Two effective Mobiles. Easily movable. Keeps overhead work on the go.

large area access platforms

built on the spot without delay

from standard *SAFWAY* Units

The adjoining SAFWAY-in-action photographs, taken at the site of the new Assembly Division, Ford Motor Co. at Dagenham, illustrate well one of the basic advantages of Safway scaffolding . . . the ease and speed with which the standard units may be assembled on the spot to produce safe, stable, mobile platforms, easily adjustable for height. Delays and costs are cut to the minimum. **Versatility PLUS.** Remember the above is just a bonus benefit to the SAFWAY user . . . these special structures are quickly built . . . and when finished with, quickly dismantled for re-use. SAFWAY Scaffolding is faster 'up-and-down' and is load-bearing too—first for Versatility.



Another Safway Access Tower — they can also be assembled in restricted space.

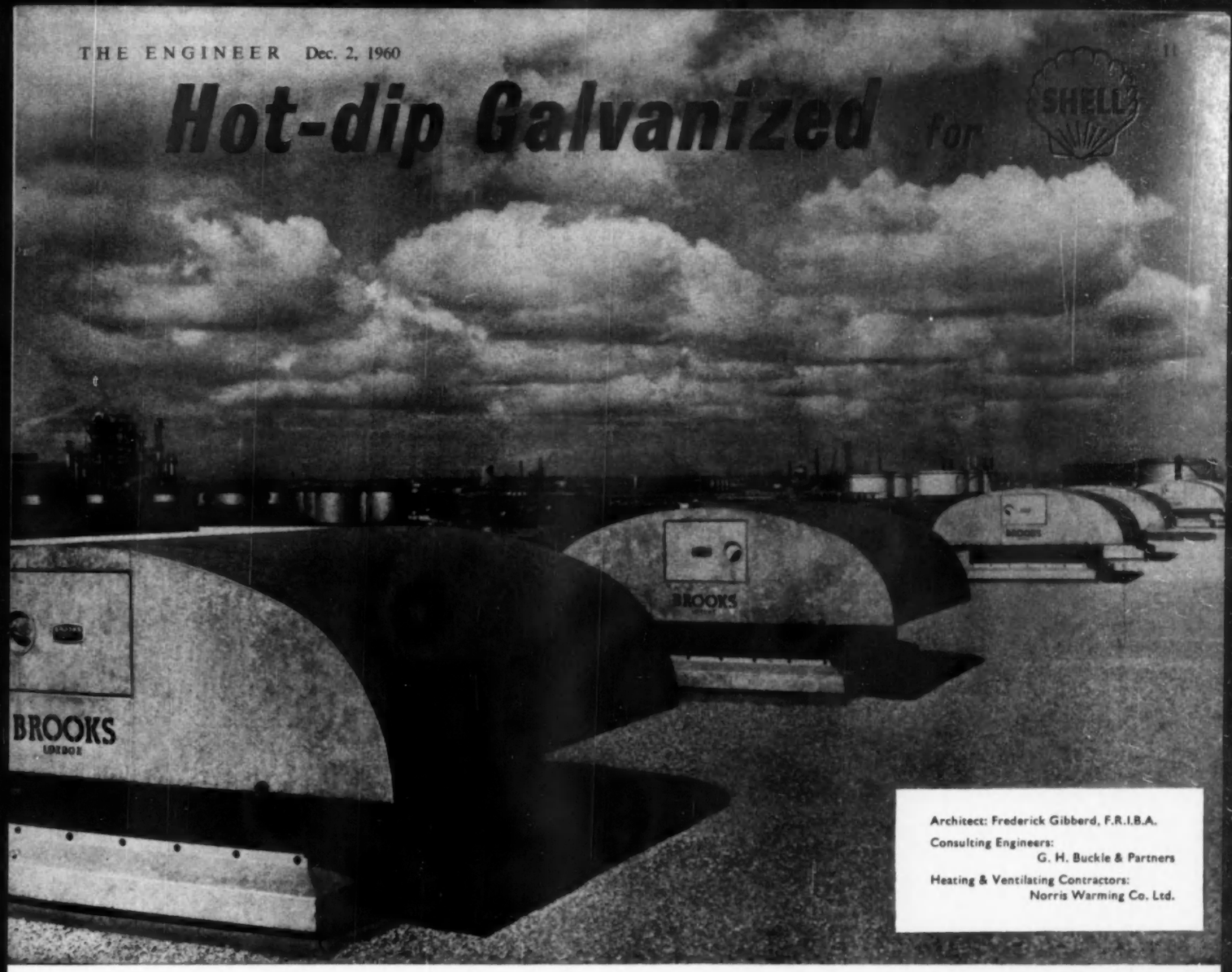
STERLING-SAFWAY

Bedford: Sterling Works, Bedford. Tel.: Bedford 5338 (3 lines)
Birmingham: 17 Berwood Road, Sutton Coldfield. Tel.: Erdington 6056
Bristol: 175 White Ladies Road, Bristol, 8. Tel.: Bristol 39112
Edinburgh: 23 Rutland Square, Edinburgh, 1. Tel.: Fountainbridge 3254/5
Glasgow: 28 Renfield Lane, Glasgow, C.2. Tel.: City 6201/2
Jarrow: Sterling Factory, Jarrow, Co. Durham. Tel.: 89-7721/2/3
London: Iddesleigh House Caxton Street, S.W.1. Tel.: ABBey 3017/8 (2 lines)

STERLING SAFWAY

Enter No. 101 on reply card

Hot-dip Galvanized for SHELL



Architect: Frederick Gibberd, F.R.I.B.A.
Consulting Engineers: G. H. Buckle & Partners
Heating & Ventilating Contractors: Norris Warming Co. Ltd.

★ Brooks 48″, 36″ and 30″ fan-powered roof extract units were chosen to provide positive ventilation for the Lubricating Oil Laboratories (Engine Bay) at the new Shell Research Centre, Thornton, Cheshire.

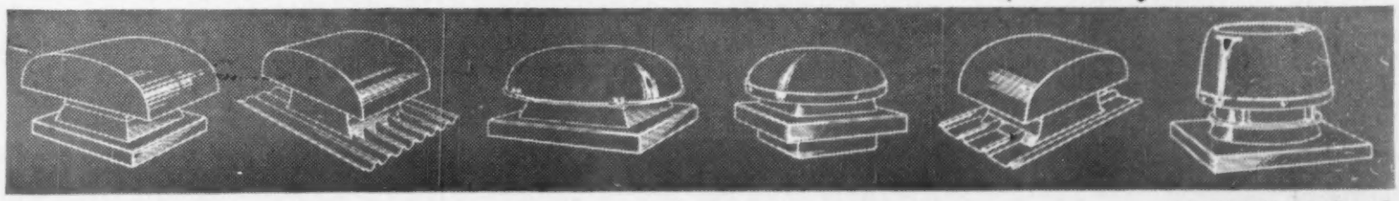
Easy to install and easy to maintain, 'Brooks' Fan-Powered Units are equally suitable for flat, decked or pitched roof constructions. Unitary ventilation provides a wide range of control over rate of ventilation, giving flexibility to suit all factory processes. Hot-dip Galvanized finish gives permanent protection.

BROOKS

VENTILATION
fan-powered

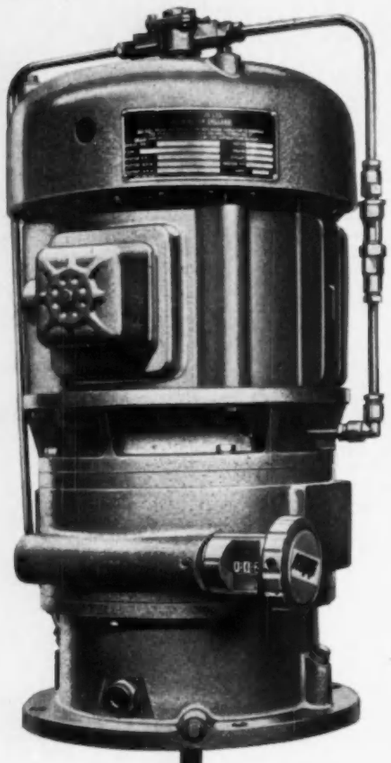
BROOKS VENTILATION UNITS LIMITED

TRAFALGAR HOUSE, BEDFORD PARK, CROYDON, SURREY. Telephone: Municipal 2361 (6 lines)
Branch Office: CROMFORD HOUSE, CROMFORD COURT, MANCHESTER 4 Telephone: Deansgate 2920



Enter No. 111 on reply card

BRITAIN'S WIDEST RANGE OF POWERED VENTILATION UNITS



- Particularly suitable for stirring and agitating applications.
- Self-contained lubrication system.
- The danger of oil leaks has been eliminated by the use of a special flinger arrangement which will not deteriorate in service.
- Available in sizes ½ to 5 H.P. with standard stepless speed variation over a 9 to 1 output speed range.
- The motorised unit illustrated can be supplied with input speeds of 960 or 1440 r.p.m. giving output of 320 to 2880 and 480 to 4320 respectively. Lower output speeds are obtainable by fitting flange mounted reduction gears to the output shaft.
- Units can also be supplied with the output shaft upper-most.

a gearless gearbox for **VERTICAL** mounting

Kopp

VARIABLE SPEED GEAR

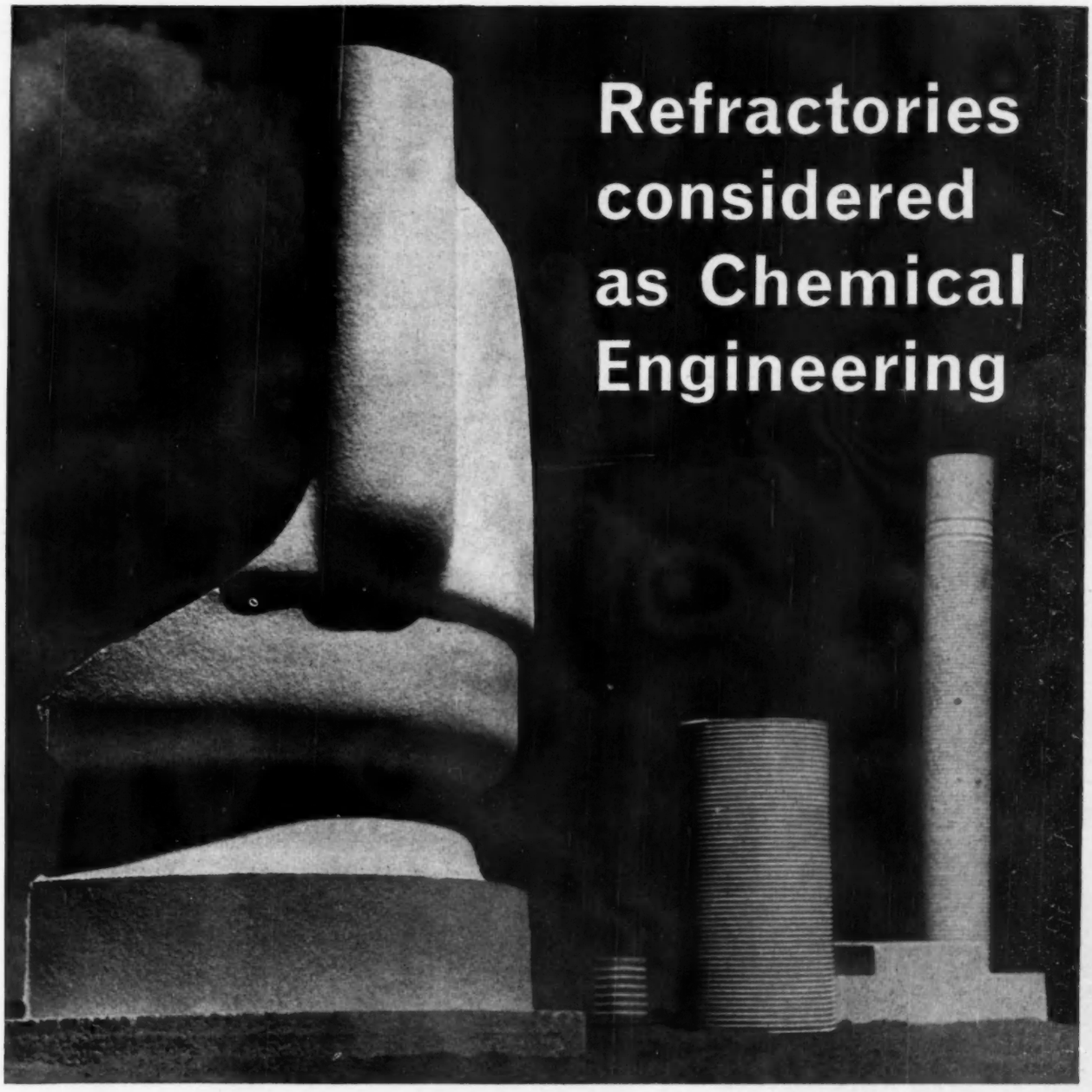
60, Royal Works, P.O. Box 43,
Clayton-le-Moors, Accrington, Lancs.
Telephone: Accrington 35441 (8 lines)

LONDON
39 PARK ROAD (NORTH JUNCTION), W.2. TEL: ADDEN 7150
SCOTLAND
P.O. BOX [illegible] STRATHKELVIN, GLASGOW. TEL: KIRBY 3210
MIDLANDS
CRANFORD HOUSE, 24 LIVERY STREET, BIRMINGHAM 3. TEL: CENTRAL 0897
YORKSHIRE
ROYAL WORKS, CANAL ROAD, LEEDS 12. TEL: [illegible]

ALLSPEEDS LTD.

PLEASE ASK FOR ONE OF OUR DEMONSTRATION VANS TO CALL AT YOUR WORKS

Enter No. 131 on reply card



Refractories considered as Chemical Engineering

Once upon a time—and a very misleading time it was—the alumina content of an alumino-silicate refractory used to be offered as almost the sole criterion of excellence. The idea had the attraction of simplicity—but made very little sense. A good refractory is a complex piece of chemical engineering, its performance depending on many factors. How it is made can be as important as the precise nature of the materials it is made from.

At Neston this principle is implemented to the full. Throughout the works scientific control is employed both in the development and production processes. The laying-down of very tight specifications ensures that the quality of the finished products is maintained with a minimum variation. This applies both to fired refractories and to the wide range of castable and mouldable refractory materials. All finished products are subjected to an extremely rigorous system of inspection carried out by an inspectorate entirely free of works control and concerned only with quality.

MORGAN Refractories Ltd

MORGAN REFRACTORIES LTD., NESTON, WIRRAL, CHESHIRE. TELEPHONE: NESTON 1406

NE163/A

Enter No. 131 on reply card

C

B. L. & N. PHILLIPS LTD.,
THE PEST CONTROL SPECIALISTS
INVITE YOU TO
MAKE YOUR PEST CONTROL PROBLEM
THEIR PROBLEM

Their service is a nation-wide one and they would be pleased to arrange for a representative to call upon you, without obligation, to discuss your problem.

B. L. & N. PHILLIPS LTD., Vermin destroyers. 124, Southwark Street, London, S.E.1. WATerloo 5546

BIRMINGHAM: 37, Thorp Street, 5. Tel: Midland 9042

BRISTOL: Swan House, 112, Hotwell Road, 8. Tel: Bristol 20512

EXETER: 21, Church Lane, St. Sidwell's. Tel: Exeter 54181

EDINBURGH: Pesticidal Services (Scotland) Ltd., 5, Northumberland Place, Edinburgh, 3. Tel: Waverley 3778

GLASGOW: Pesticidal Services (Scotland) Ltd., 93, Waterloo Street. Tel: City 0753

SOUTHAMPTON: 7, College Place, London Road, Southampton. Tel: Southampton 25307

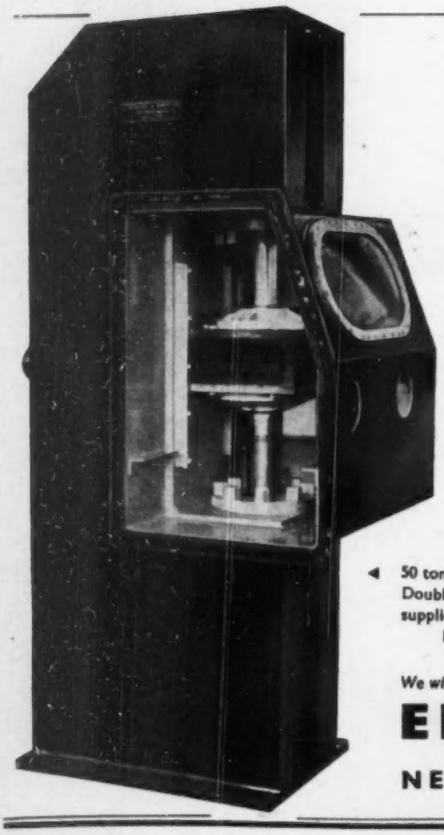
LEEDS: 21, Upper Mill Hill. Tel: Leeds 2-5266

LIVERPOOL: 8a, Rumford Place, 3. Tel: Central 2068

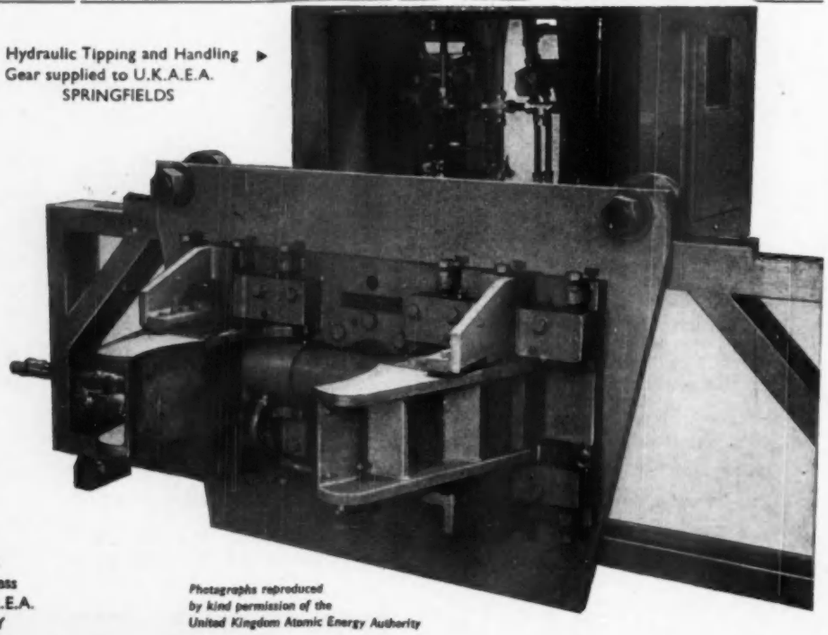
BELFAST: Pesticidal Services (Ireland) Ltd., 153, Upper North Street. Tel: Belfast 26998

Enter No. 141 on reply card

SPECIAL PURPOSE EQUIPMENT SUPPLIED TO U.K.A.E.A.



Hydraulic Tipping and Handling Gear supplied to U.K.A.E.A. SPRINGFIELDS ▶



◀ 50 tons Hydraulic Double Acting Press supplied to U.K.A.E.A. DOUNREAY

Photographs reproduced by kind permission of the United Kingdom Atomic Energy Authority

We will be pleased to quote for any Special Purpose Machinery

ENTWISLE & GASS LTD.

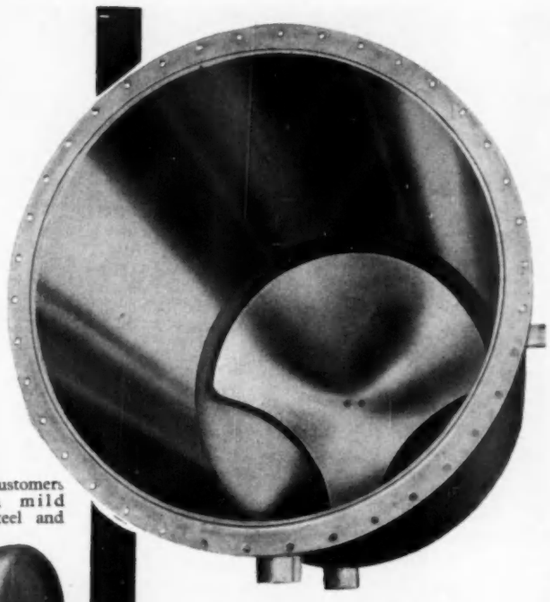
ASSOCIATED WITH THE PLANTERS ENGINEERING CO., LTD. LONDON

NELSON STREET, BOLTON

Telephone: No. 5967/8

Established 1852

Enter No. 142 on reply card



Fabrications to customers' specifications in mild steel, stainless steel and copper.

Illustrated are recent examples of copper calorifier body, and stainless steel jacketed sterilizer chamber.

Fabrications by...

THOS. MARSHALL

& SON LTD.

WELLINGTON BRIDGE

LEEDS 12 Tel: 32186 (5 lines)

Enter No. 151 on reply card

Ω OMEGA

the world's most accurate timer

Chosen to time the Olympic Games since 1932

NOW AVAILABLE TO INDUSTRY THROUGH

PRESTONS

LIMITED

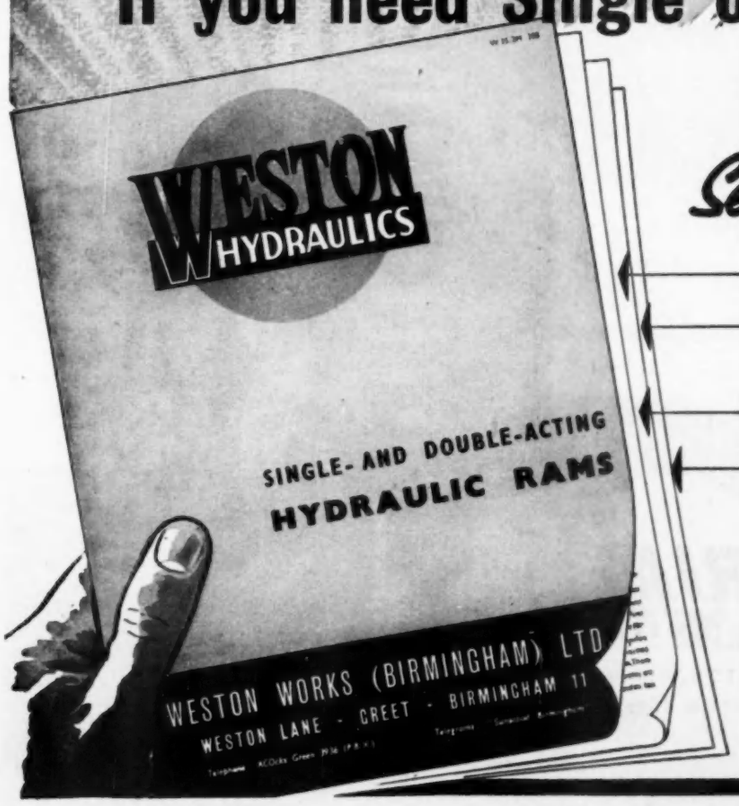
THE STRAND · BLACKPOOL · LANCS

THE LARGEST SUPPLIERS OF STOP WATCHES TO INDUSTRY

Enter No. 152 on reply card

If you need Single or Double acting Hydraulic Rams

Send for this Booklet



- offering a wide standard range of hydraulic rams.
- All data regarding installation, dimensions, stroke, etc. is included.
- Full details of bores from 1¼" dia. to 6" dia.
- Precision made units to meet the requirements of earth moving, industrial and agricultural machinery manufacturers.

SEND FOR IT NOW

DEPT. E.5, WESTON WORKS (BIRMINGHAM) LIMITED

WESTON WORKS, GREET, BIRMINGHAM, 11.

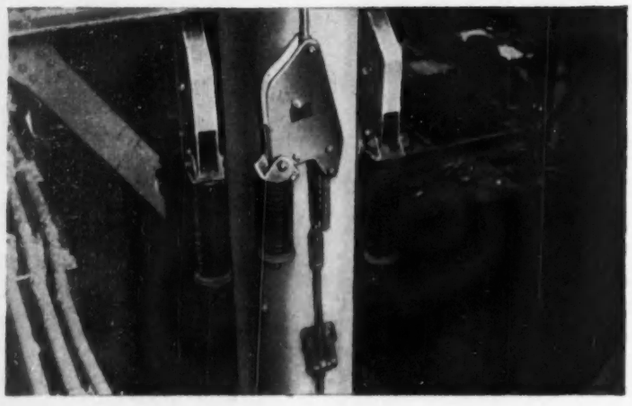
Enter No. 153 on reply card

For controlled pipe movement . .

CON-TEN

REG. TRADE MARK

CONSTANT TENSION PIPE SUPPORTS



The Con-Ten system has not only been tested, but *proved* in industries and power stations all over the world. No matter what the load or the pipe movement, or the problems met, there is a Con-Ten to provide the most adequate and *permanent* support available. Loads from 100 lbs. to 14 tons and pipe movements up to 18 in. can be controlled by constant tension supports in the Con-Ten range.

Contact us now for full information.

British Patent Nos. 474008, 720074, 720075, 697987, 816976, *U.S.A. Patent No.* 2129320.

BRITISH INDUSTRIAL

ENGINEERING COMPANY (STAFFS) LIMITED

CORONATION WORKS, HAINGE ROAD, TIVIDALE, TIPTON, STAFFS.

Tel: TIPTON 1222/3/4

Enter No. 161 on reply card

CONVEYOR AND ELEVATOR Co (1936) LTD.

LOWER BRIDGE WORKS

SPIRAL CONVEYORS,
BUCKET ELEVATORS, Etc.

ACCRINGTON

Telephone: No. 2779
Telegrams: "Conveyor," Accrington

Enter No. 171 on reply card

RUBBER BY-PRODUCTS (Warwickshire) LIMITED
Dept E.,
86 Holloway Head
Birmingham 1.
Tel.: MID. 3475

Enter No. 172 on reply card

Ex. Govt. ANGLE MEASURING CLINOMETER
(As illustrated)
Invaluable for setting angles for milling, shaping and for jigs, etc. Post Free 55/-

MK. IV MICROMETER CLINOMETER
Accurate to about two minutes. Simple to adapt for tool-room use. 27/6

GERMAN DRAWING INSTRUMENT SETS
Brand new in velvet lined case £2·7·6

Any item on 14 DAYS APPROVAL

Ex. Government
3" to 4" MICROMETERS 45/-

Ex-Gov. Smiths Revolution Counters
Fitted with two separate trip counters. Range 0-1,400 r.p.m. Dial diam. 4". Brand new 20/-

TIME & MOTION STUDY STOP WATCHES
Cost price approx. £7. Offered in perfect condition. 52/6

Also available Ex-M.O.S. High quality WALTHAM STOP WATCHES
1/5th second with minute recorder £3.15.0

Decimal dials can be fitted to most of our Stop Watches if desired

The New Baker Tool-room Stereoscopic Microscope
Full details on request £34

CHARLES FRANK 67-75 Saltmarket, Glasgow C.1.
Phone: BELL 2106/7 Established 1907 Grams: BINOCAM Glasgow
Britain's greatest stocks of new, used and ex-Government Binoculars, Telescopes and all Optical and Scientific Equipment. Send for illustrated catalogue.

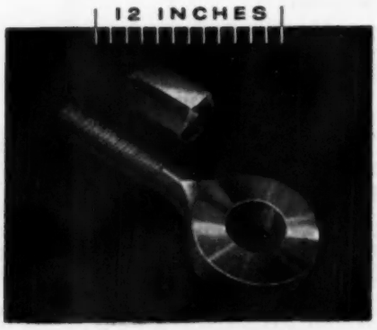
Enter No. 173 on reply card

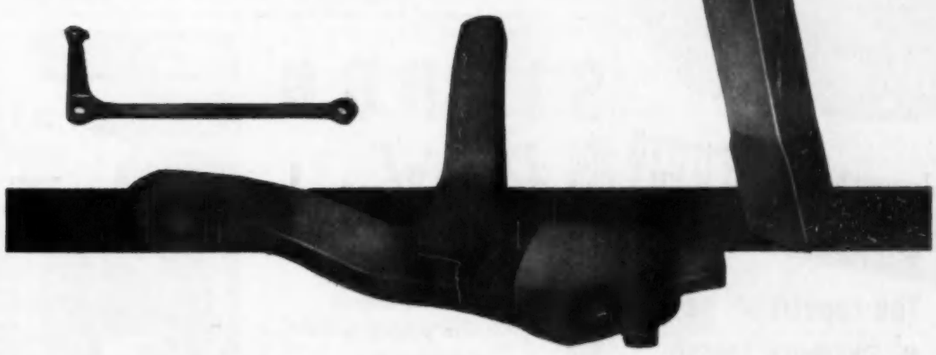
accurate, high quality

HAND AND HAMMER FORGINGS

Specialists in accurate high quality hand and hammer forgings in carbon or alloy steel, "as forged" or fully heat treated.

All finished machined work completed in our own machine shops.





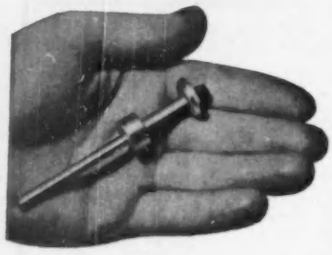
CULL

W. B. CULL & SONS LTD.
POWKE LANE,
OLD HILL,
STAFFS.

Phone: Cradley Heath 66071/5
Grams: Culsons, Cradley Heath

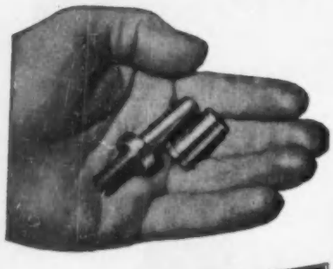
Enter No. 174 on reply card

small



parts?

A job for



FORDSMITH OF MANCHESTER

The repetition people

H. FORDSMITH LIMITED,
Hadfield Street Works, Cornbrook,
Manchester, 16.
Telephone : Trafford Park 1615-6

F.S.

Enter No. 181 on reply card

"Where's the T.V. Belt Dad?"

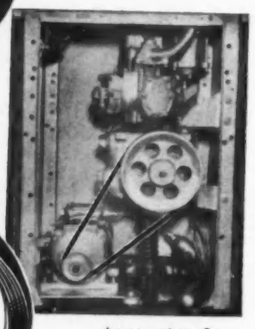
Reg.

THE MARK OF BETTER BELTING

TURNERS V-BELTS

Our little friend, knowing that there is a motor inside the petrol pump, naturally assumes there must be a T.V. Belt. And he is right too! T.V. Belts (Turners V-Belts of course) are used in every petrol pump sold by Gilbarco Ltd.* Helping you to your petrol is another application for which T.V. Belts are the natural choice - be natural too and specify Turners products for all power transmission.

TURNERS V-BELTS
Rayon or "Terylene" Corded



Interior view of a Gilbarco pump, made by Vickers-Armstrong Engineers) Ltd., Crayford

* Gilbarco pumps dispense all leading brands throughout the country.

Please write for details of all power transmission products including the new "Poly-V" Drive

TURNER BROTHERS ASBESTOS CO LTD ROCHDALE ENGLAND
A MEMBER OF THE TURNER & NEWALL ORGANISATION

TA 197

Enter No. 182 on reply card

SIRRON

Diesel Engines

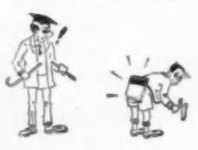
Main Propelling Diesel Engines in powers up to

1,200 H.P.

THE NEWBURY DIESEL CO. LTD.
NEWBURY, BERKS

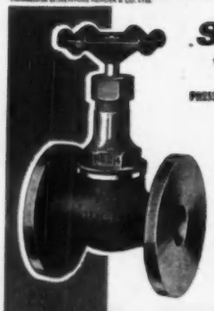
Enter No. 183 on reply card

VEE-REG



STOP VALVES
WITH PROTECTED SEAT

PRESSURES UP TO 800 P.S.I. TEMPERATURES UP TO 800° F.



SUITABLE FOR STEAM, GAS, OIL, AIR AND HIGH PRESSURE HOT WATER.

THE ***VEE-REG*** VALVE IS A COMBINATION OF A STOP VALVE AND A REGULATING INSTRUMENT.
IT IS EQUIPPED WITH A UNIQUE FORM OF DISK AND SEAT WHICH ENSURES A PROPORTIONAL FLOW THROUGHOUT THE ENTIRE LIFT OF THE VALVE.

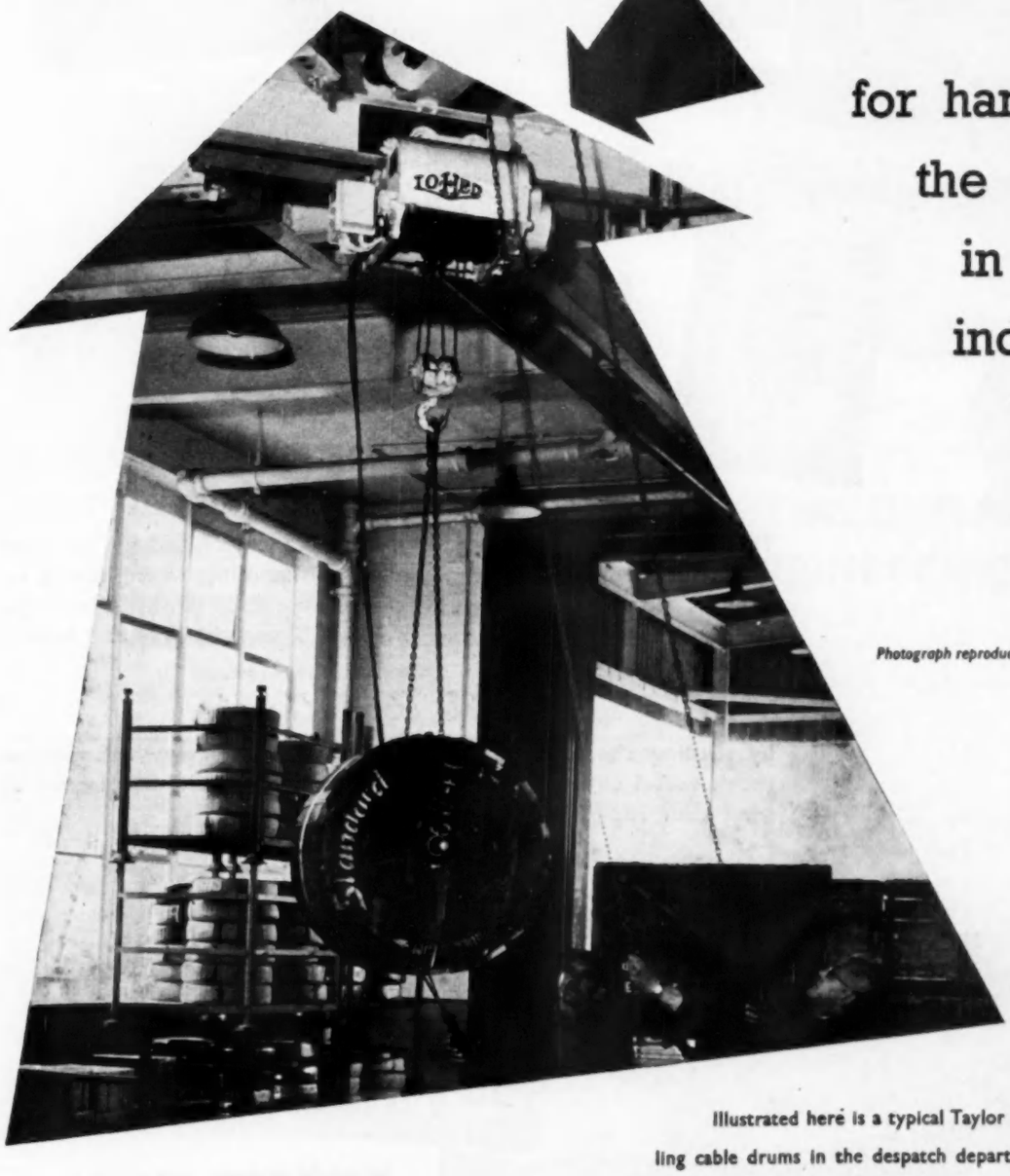
FOR ALL INDUSTRIAL PLANTS, THE ***VEE-REG*** VALVE PROVIDES AN ADVANCE FROM NORMAL GLOBE VALVE PERFORMANCE, REPLACING GUESS-WORK WITH POSITIVE AND ACCURATE CONTROL OF STEAM, AIR, GASES, FLUIDS, ETC.

VEE-REG Valves incorporate a protected shut-off seating which ensures complete elimination of wire-drawing.

THE BRITISH STEAM SPECIALTIES LIMITED
Head Office: FLEET STREET, LEICESTER
Also at London, Liverpool, Glasgow, Bristol, Manchester, Newcastle-on-Tyne, Birmingham, Cardiff, Belfast, Dublin

Enter No. 184 on reply card

Taylor Lo-Hed



for handling the loads in your industry

Photograph reproduced by kind permission of Standard Telephones & Cables Ltd., Newport, Monmouthshire

ELECTRIC HOISTS
OVERHEAD TRAVELLING CRANES
ELECTRIC WINCHES
CAPSTANS
TRANSPORTER HOISTS
SKIP HOISTS
CUPOLA CHARGERS
RUNWAY STRUCTURES

Illustrated here is a typical Taylor Lo-Hed Hoist installation for handling cable drums in the despatch department.

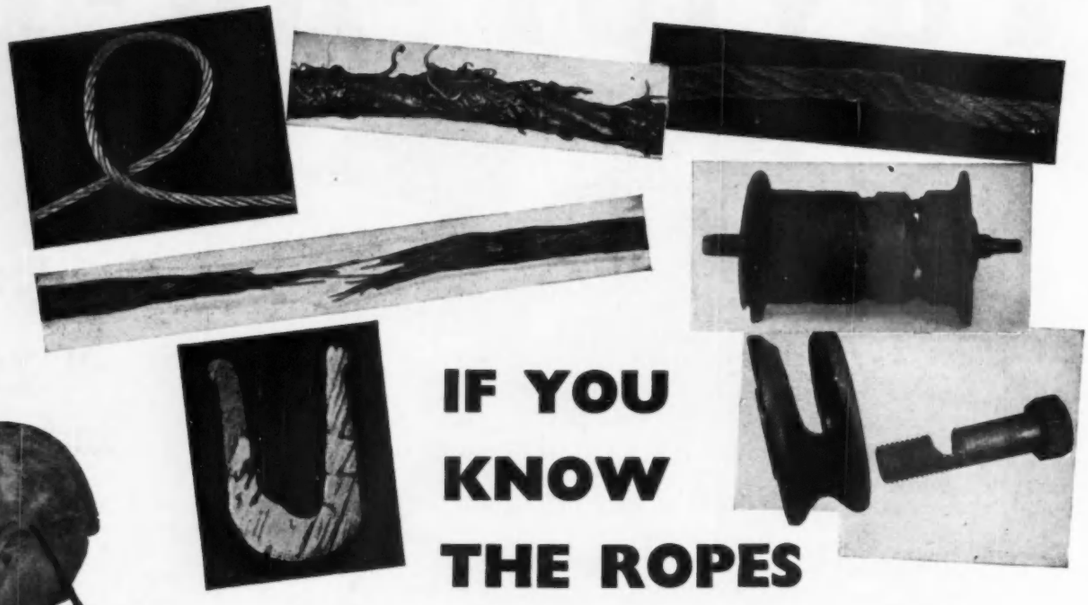
For *your* industry, factory or process, there is a wide range of Lo-Hed equipment available.

Send us your enquiries, your problems or specifications of equipment required.

TAYLOR STOKER COMPANY, LIMITED,
MATERIALS HANDLING DIVISION
189/191, Drummond Street, Euston, London, N.W.1
Phone : EUSton 9811

Enter No. 191 on reply card

THESE THINGS DON'T HAPPEN



IF YOU KNOW THE ROPES

These photographs show some typical instances of damage to ropes and associated equipment caused by mishandling, wrong fitting or neglect. In each case serious damage was caused to the Wire Rope and considerable expense was involved in replacement and loss of output.

"Give Your Ropes a Chance"

by reading the **MARTIN-BLACK** series of leaflets which contain much useful and interesting information. We will be pleased to send your copy/copies on request.

MARTIN BLACK

WIRE ROPES

MARTIN, BLACK & CO. (WIRE ROPES) LTD.,

SPEEDWELL WORKS, COATBRIDGE, GLASGOW ... ... Telephone : COATBRIDGE 567 (Priv. Exch.)

LONDON: "NUMBER TWENTYFIVE," CURTAIN ROAD, E.C.2. ... ... Telephone : BISHOPSGATE 6667/8/9
LIVERPOOL: 31 N. JOHN STREET, 2. ... ... Telephone : CENTRAL 0924 (2 lines)
NOTTINGHAM: 640 WOODBOROUGH ROAD, MAPPERLEY. ... ... Telephone : NOTTINGHAM 64397 and 66055/6
NEWCASTLE-ON-TYNE: 13 SANDHILL, QUAYSIDE. ... ... Telephone : NEWCASTLE 2-1282
CARDIFF: THE EXCHANGE, MOUNT STUART SQUARE. ... ... Telephone : CARDIFF 32162

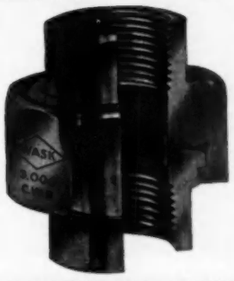
ALSO: MARTIN, BLACK WIRE ROPES (CANADA) LTD., 131, HYMUS BLVD., POINTE CLAIRE, MONTREAL, P.Q., and 285 BERING AVENUE, TORONTO.

Enter No. 201 on reply card

FORGED STEEL PIPE FITTINGS

Screwed A.P.I., B.S.T.P.T. or socket weld. Materials: Carbon steel, chrome-molybdenum or stainless steel.

C.W.P. non-shock
2000 lbs series
3000 lbs series
6000 lbs series



FORGED STEEL UNIONS

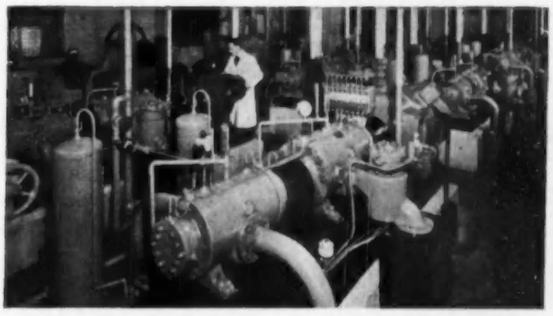
Integral seats or inserted stainless steel, chrome-molybdenum or bronze.

WALTER SLINGSBY
& CO. LTD.
RAILWAY WORKS, KEIGHLEY
'Phone: 3749 'Grams: 'Malleable Keighley'

Enter No. 211 on reply card

HOLLAND/SLM ROTARY COMPRESSORS AND VACUUM PUMPS

GIVE SERVICE FOR TO-DAY, FOR TO-MORROW AND FOR YEARS AHEAD



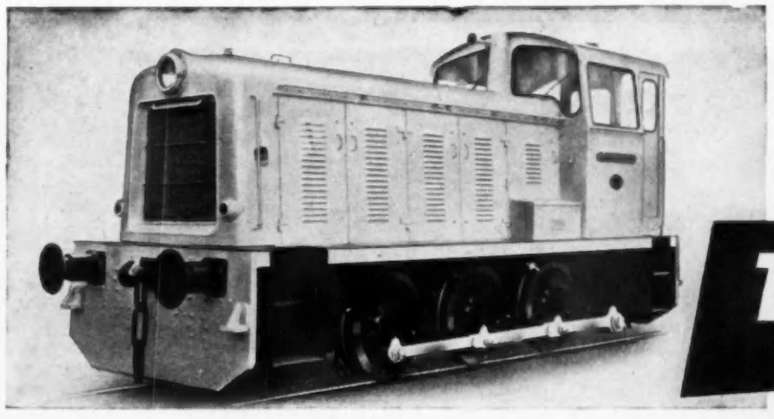
The Compressor House at Britannia Iron & Steel Works, Bedford, equipped entirely with HOLLAND/SLM rotary compressors, in constant service for over twenty-five years.

The B. A. Holland Engineering Co. Ltd.

LINDO LODGE, STANLEY AVENUE, CHESHAM, BUCKS.

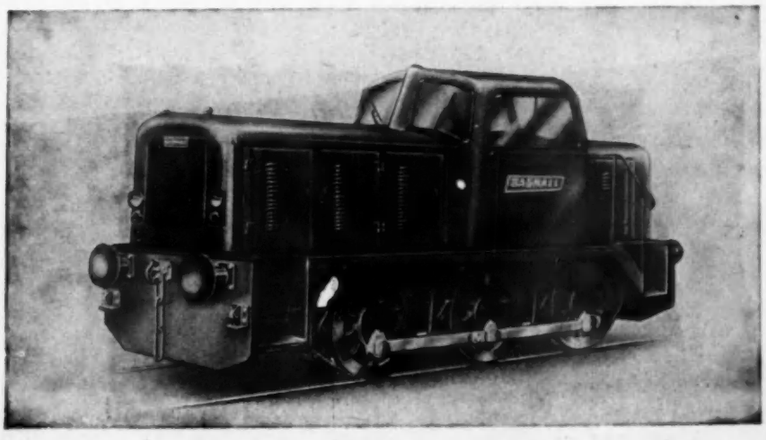
Telephone: Chesham 8406/8 Telegrams: Picturable, Chesham Works: Slough, Bucks

Enter No. 212 on reply card



Diesel Mechanical
Wheel arrangement 0-6-0
Dorman 6QA diesel engine 208 H.P. at 1,300 r.p.m.
Weight 33.5 tons
Starting Tractive Effort 17,060 lbs.

Right on the rails with BAGNALL



Bagnall are always on the rails right from the design stage — when it comes to locomotives: mostly diesel. They plan them, design them, build them, and power them with any first class diesel engine — Dorman, for example. And they're the best, here and throughout the world.

W. G. BAGNALL Ltd., Stafford, England.
Telephone: Stafford 321/2 *Grams & Cables:* Bagnall Stafford, England.
London Office: 1 Hay Hill, W.1.

Diesel Hydraulic
Wheel arrangement 0-6-0
Dorman 6QAT diesel engine 342 H.P. at 1800 r.p.m.
Weight 48 tons
Starting Tractive Effort 32,300 lbs.

Enter No. 213 on reply card

"Albion"
INDUSTRIAL COUNTING INSTRUMENTS and MEASURING MACHINES

Patented Design

Let us solve your counting and measuring problems

Write or phone for our Catalogue or a visit from a technical representative to "INSTRUMENT DIVISION"

B. & F. CARTER & CO., LTD.
ALBION WORKS, BOLTON 3, ENGLAND
Tel: BOLTON 4344 (All lines)
Grams: "BRAIDERS BOLTON"

Enter No. 221 on reply card

OIL STORAGE TANKS
Cylindrical, Rectangular and Sitewelded. Capacities from 25 gall. to 30,000 gall.

PRESSURE VESSELS
Butane and Propane Storage Vessels, Columns, Cooling and Scrubbing Towers, Air Receivers, Chemical Storage Vessels. Full details supplied on application.

Also Manufacturers of Ducting and Fabrications. Large Machining Capacity Available.

ROBERTS BROS.
ESTABLISHED 1919
JUNCTION ROAD, WORDSLEY, STOURBRIDGE WORCS.
Tel: STOURBRIDGE 3101/2/3

Enter No. 222 on reply card

AUTOMETRIC
CENTRIFUGAL MOTOR PUMPS
3/4" - 1 1/2"

CAST IRON, BRONZE OR STAINLESS STEEL
CHOICE OF THREE MECHANICAL SEALS
send for details of this and other types

AUTOMETRIC PUMPS LTD
LOWER WATERSIDE · MAIDSTONE · KENT
TELEPHONE: MAIDSTONE 4728

Enter No. 224 on reply card

MORE Schieldrop Industrial Oil Burners are used by
MORE and more leading engineers and
MORE Schieldrop S.P.O. Burners have been sold
MORE than any other make
IN GREAT BRITAIN

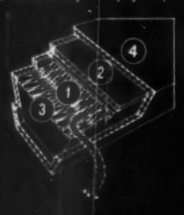
LONDON
Tel: Belgravia 3785
MANCHESTER
Tel: Blackfriars 3851
SOUTH WALES
Tel: SKEWEN 3383-3103
BIRMINGHAM
Tel: Erdington 2772

Schieldrop Industrial Burners
SCHIELDROP & CO. LTD., STOTFOLD, BEDS · Tel 414 (4 lines) BMJ

Enter No. 223 on reply card

You will transmit more power
with BTR HIGH TEST V-Belts
— *the belts with the High Capacity ratings*

When you equip your drives with BTR HIGH TEST Industrial V-Belts you gain higher horsepower transmission, greater production for electricity consumed and far longer belt life. Mono-cord construction (for belts below 95" in length) means greater flex life round the smaller pulleys and elimination of the tendency for ply separation. The diagram shows (1) the inner core of the load carrying member, (2) the filler, (3) the rubber cushion and (4) the 2-ply cover of specially woven wear resisting material of a BTR HIGH TEST V-Belt. This mono-cord construction is available in sections M, A and B.

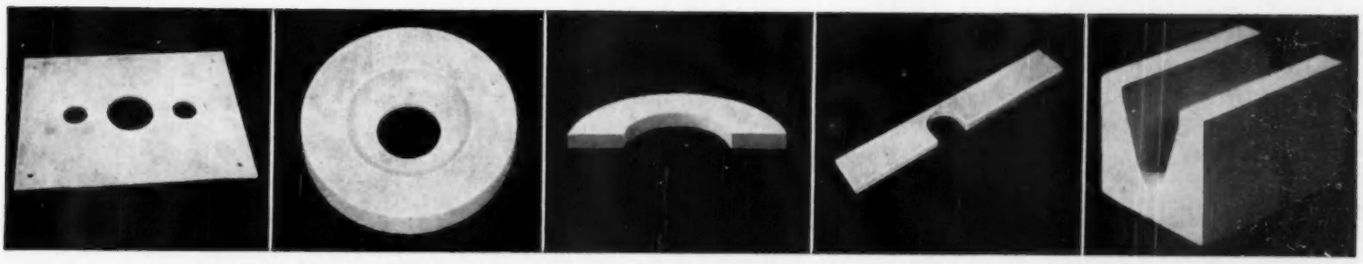


BTR Industries Ltd
BTR
BRITISH THERMOPLASTICS AND RUBBER MANUFACTURERS
HERGA HOUSE, VINCENT SQ., LONDON S.W.1

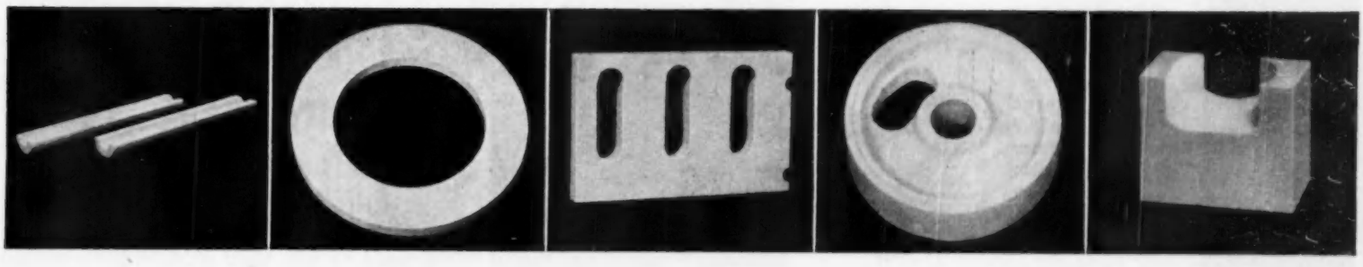
Enter No. 225 on reply card

2/3124A

Each one of the objects
in this photograph is a machine part
from which is required a
specialised performance
combining:
Rigidity
Strength
Low thermal capacity
Non-combustibility
Chemical inertia
Machinability



we call them "specials"



Each has been machined in our factory
from flat Marinite sheet (up to 4 ins thick)
to a drawing provided by the user

can we turn one out for **you?**

MARINITE

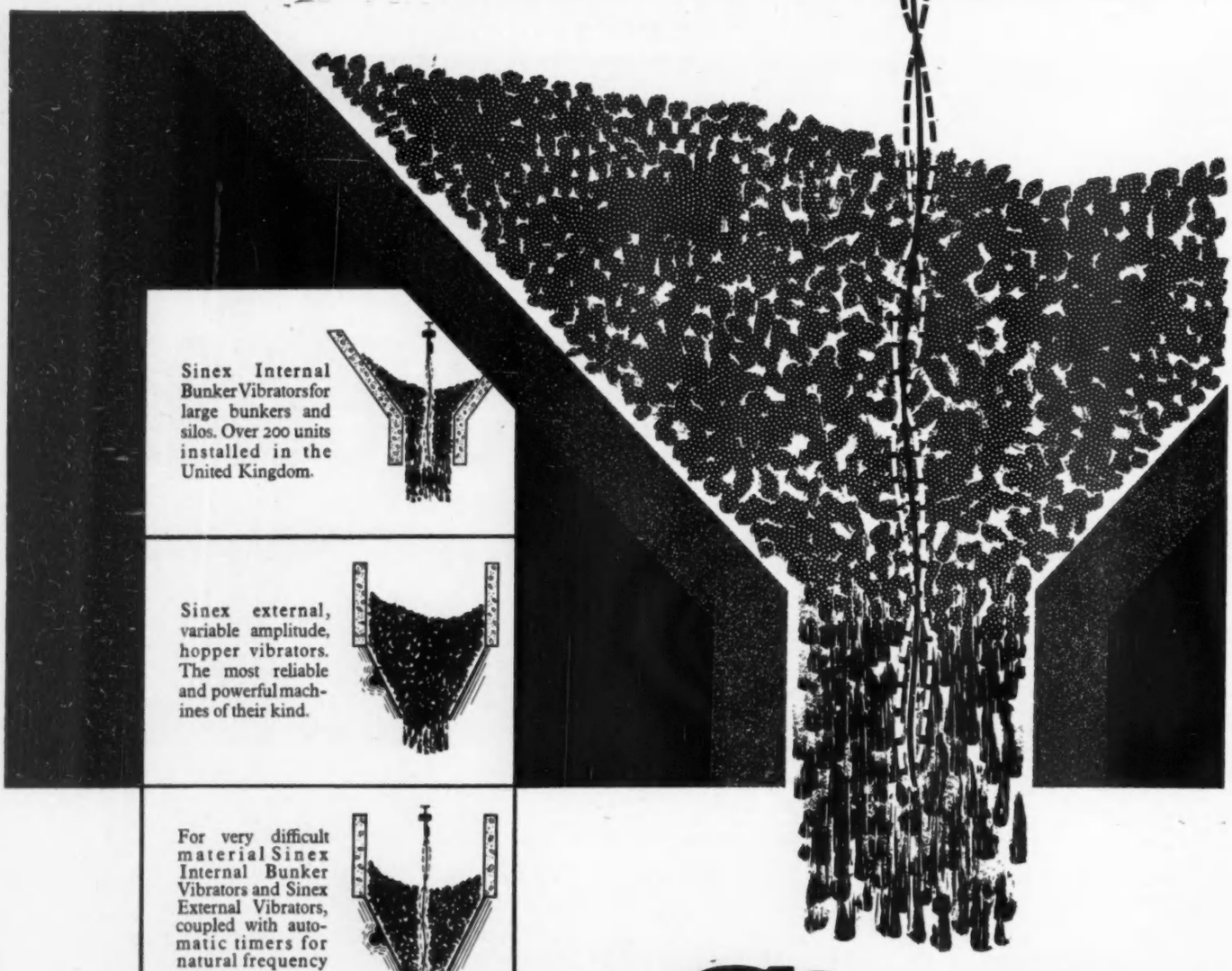
25 & 27 North Row, London W.1

Telephone: GROsvenor 5115. Telex: Incorrupt London

Enter No. 231 on reply card

Trouble free bunker discharge with internal and external

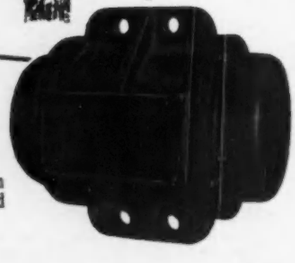
VIBRATION



Sinex Internal Bunker Vibrators for large bunkers and silos. Over 200 units installed in the United Kingdom.

Sinex external, variable amplitude, hopper vibrators. The most reliable and powerful machines of their kind.

For very difficult material Sinex Internal Bunker Vibrators and Sinex External Vibrators, coupled with automatic timers for natural frequency response.



Sinex Engineers have 30 years experience of the scientific application of controlled vibration.

Sinex

VIBRATORY EQUIPMENT

Sinex Engineering Company Ltd.,

Central Way, North Feltham Trading Estate, Feltham, Middx.

Telephone: Feltham 5081 (5 lines). Telegraphic Address: Sinexvibro Feltham.

ASSOCIATED COMPANIES IN PARIS, BRUSSELS & ZURICH

Enter No. 241 on reply card

Cast with Precision

* Aluminium and magnesium alloy castings by sand, die, shell and plaster mould methods.
* Engine blocks and cylinder heads in high duty iron.
* Castings of the highest quality in the desired quantities at the right time.
* The greatest technical experience augmented by quality control of production.

Automatic Transmission Part in Aluminium produced by Shell Moulding. The slots are in the 'as cast' state and are not machined. By courtesy of Hobbs Transmission Limited.

STERLING METALS LTD

PHONE NUNEATON 4221

STERMET

Enter No. 251 on reply card

STEEL PLATES & SHEETS SHEARED TO SIZE

CUSTOMER'S OWN MATERIAL SHEARED

PROMPT DELIVERY

TUDOR SHEARING COMPANY LTD.

BARNFIELD ROAD . TIPTON . STAFFORDSHIRE

Tel.: Tipton 3062-4 Telex: 33-465

Enter No. 252 on reply card

MICA Processed for all uses

COMMUTATOR SEGMENTS, HEATING ELEMENTS, SWITCHGEAR, ETC.

VARNISHED COTTON

INSULATING SLEEVING

In various colours

Deliveries from stock

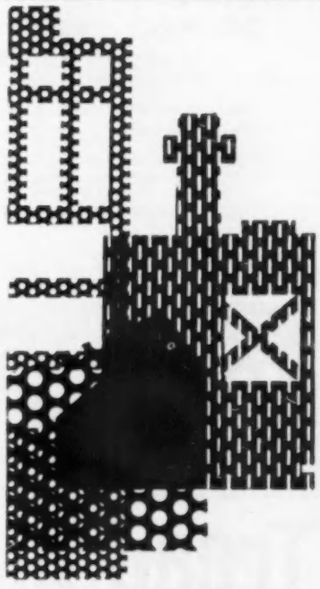
Special Organization for prompt deliveries

L. VANDERVELDE LTD.

Gnome Works, Stansted, Essex.

Phone : Stansted 3261

Enter No. 253 on reply card



PERFORATED METALS FOR INDUSTRY

J. & F. Pool Perforated Metals are today giving splendid service in over 40 great industries. It is first-class equipment at the right price!

Pool

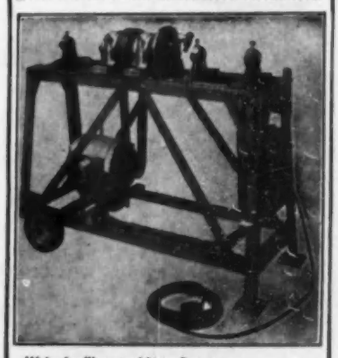
J & F POOL LTD

HAYLE, CORNWALL Hayle 3213

Enter No. 254 on reply card

ROTA-CLEAN

BAR AND TUBE CLEANING MACHINE



Write for Illustrated List—Patent.

D. G. McNAIR & CO., LTD., 569 Govan Road, GLASGOW, S.W.1.

Enter No. 255 on reply card

Heavy Gauge Steel SHELVING

£3·15·0

DELIVERED FREE!

- Brand new—Manufactured in our own works.
- Shelves adjustable every inch.
- Heavy gauge shelves will carry 400 lb. each.
- Stove enamelled dark green.
- 6 shelves per bay—Extra shelves 8/- each.
- Quantity discounts.

Other sizes available. Also available in white at £5 per bay

THE ONLY HEAVY GAUGE SHELVING AT THIS PRICE

N.C.BROWN LTD

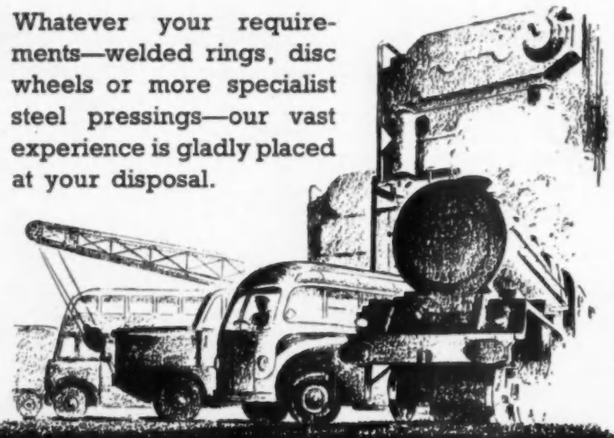
GREEN LANE STEELWORKS · HEYWOOD · LANCS · TEL.: 69018 (6 LINES)

Enter No. 261 on reply card

From our presses come the needs of Industry . . .

In almost every branch of Industry the pressings from Steel Stampings Ltd., can be found satisfying a vital need.

Whatever your requirements—welded rings, disc wheels or more specialist steel pressings—our vast experience is gladly placed at your disposal.



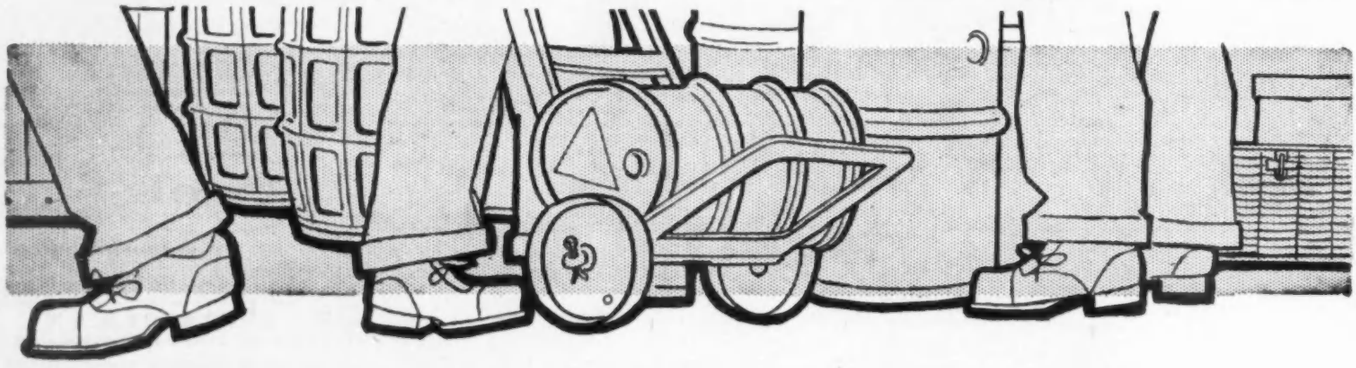
STEEL STAMPINGS LTD

COOKLEY NR. KIDDERMINSTER

'Phone WOLVERLEY 266 (2 lines) 'Grams: STAMPINGS, COOKLEY

Enter No. 262 on reply card

Tread and Trundle - Wear and Tear



Concrete can't take it half so well as . . .

Withstands heavy traffic. High Impact Strength. Jointless. Non Slip. Obviates dust hazards. Light in weight. Can be applied to various surfaces. Economical and hard wearing.

AND CHEMICAL RESISTANT

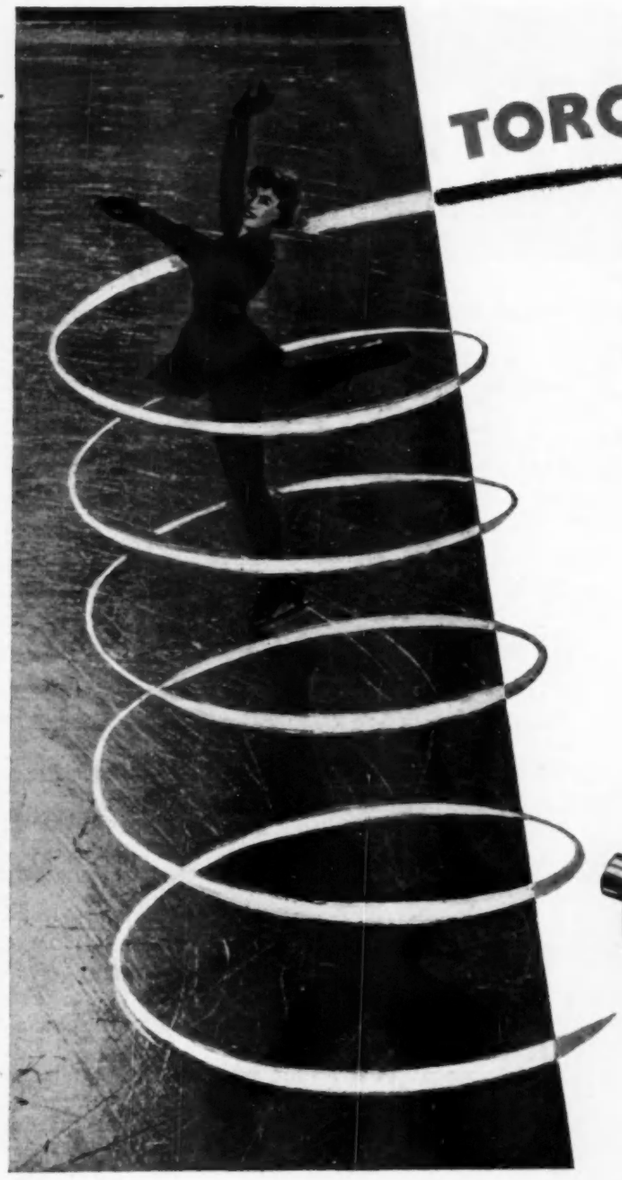
Ceradek will provide the most likely solution to your flooring problems. Our technical staff will gladly advise you on all aspects of Ceradek installation, supplying further details and quotations as required.

Epoxy
SCREEDED FLOORING

Ceradek

Laid only by:
TECHNICAL APPLICATIONS LTD., VALLEY WORKS, MONTON ROAD, ECCLES, LANCASHIRE Eccles 1737

Enter No. 263 on reply card

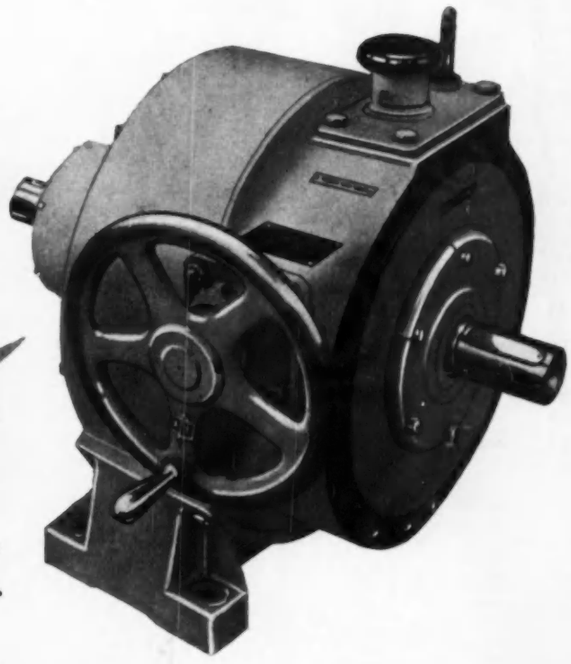


TORQUE MAGNIFICATION

The ultimate in power transmission . . .

VOITH/N.B.L.

VARIABLE RATIO TORQUE CONVERTERS



In conjunction with electric motors or diesel engines as power source are particularly suited for

Rolling Mills - Tube and Wire-
Draw Benches - Straightening
Presses - Hammer Mills - Pumps
Rotary Boring Rigs - Shovel Loaders
Excavators - Winches and Cranes

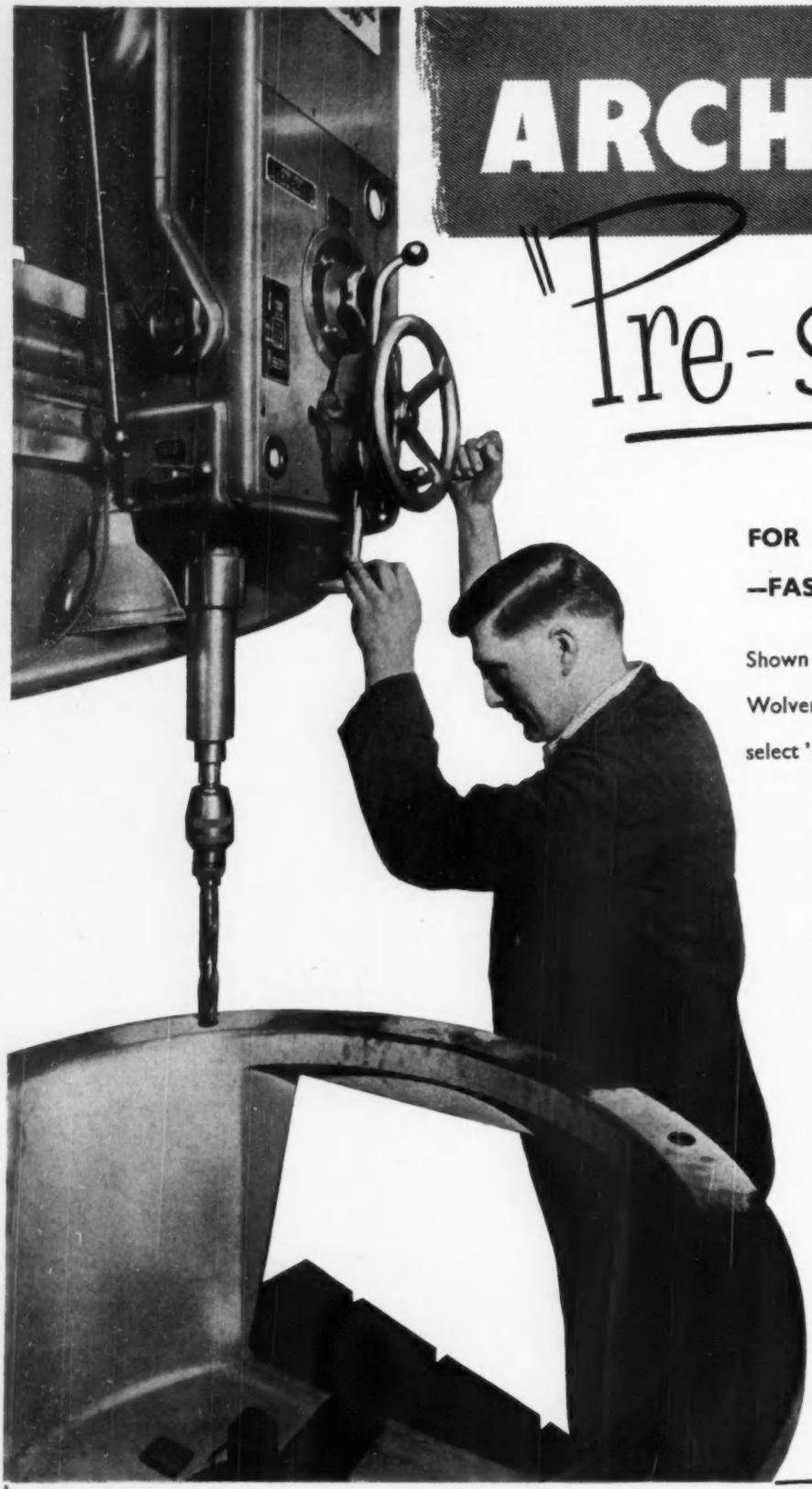
The Converter with unique Control System employing variable opening reaction blades controlling torque output in a range of sizes from 20 H.P. up to several thousand horsepower through one transmission. Ideal for precise and accurate control of driven machinery employing constant speed prime movers.

NORTH BRITISH LOCOMOTIVE

CO. LTD., GLASGOW

LONDON OFFICE: LOCOMOTIVE HOUSE, BUCKINGHAM GATE, S.W.1

Enter No. 271 on reply card



ARCHDALE

"Pre-select"

FOR GREATER OPERATING SPEEDS —FASTER PENETRATING CAPACITY

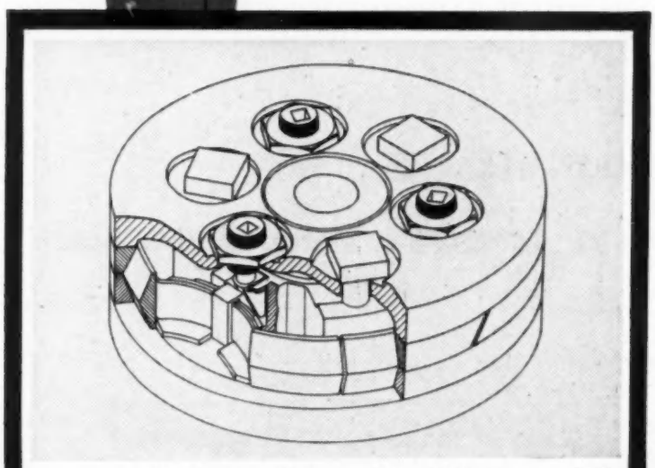
Shown in use at The Electric Construction Co. Ltd., Wolverhampton, this ARCHDALE mechanical 'Pre-select' is fully meeting our claims to cut production times to a minimum. Not only are penetration rates as high as power and rigidity can make them, but much valuable time is saved by convenient pre-selection from 16 spindle speeds, at any time whether the spindle is running or stationary. Spindle speeds range between 15 and 1500 r.p.m. and the six rates of feed, selected by a single lever, between 24 and 400 R.P.I.

N.B. The illustration shows the drilling and spot facing of main fixing holes in end brackets for 250 B.H.P. electric motors.

JAMES ARCHDALE & CO. LTD.

Registered Office: **LEDSAM STREET, BIRMINGHAM 16** *Tel. Edgbaston 2276*
Works: **BLACKPOLE WORKS, WORCESTER** *Tel: Worcester 27081 (6 lines)*
A MEMBER OF THE STAVELEY COAL AND IRON CO. LTD. GROUP
Sole Selling Agents: **ALFRED HERBERT LTD., COVENTRY** *Tel. Coventry 89221*

Enter No. 281 on reply card



The Bower and Qualter Patent Piston 1860

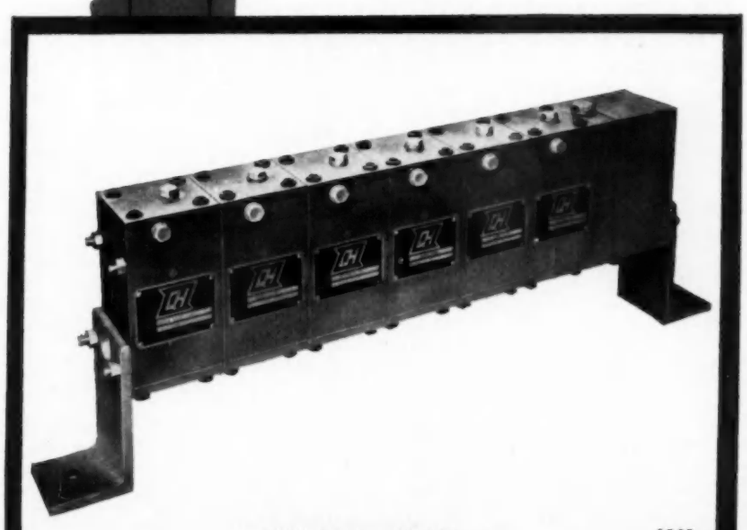
1860

QUALTER HALL

AND COMPANY LIMITED

1960

This is our centenary year . . .



Q.H. Pneumatic Valves 1960

A company is judged by present efficiency and future capabilities— not by past glories. At Qualter Hall we recognize this fact and use our century of engineering experience as a basis for today's achievements and tomorrow's promise.

A51

QUALTER, HALL & CO. LTD. P.O. BOX No. 8 · RAILWAY FOUNDRY · BARNSLEY

Enter No. 291 on reply card

PERMUTIT WATER TREATMENT

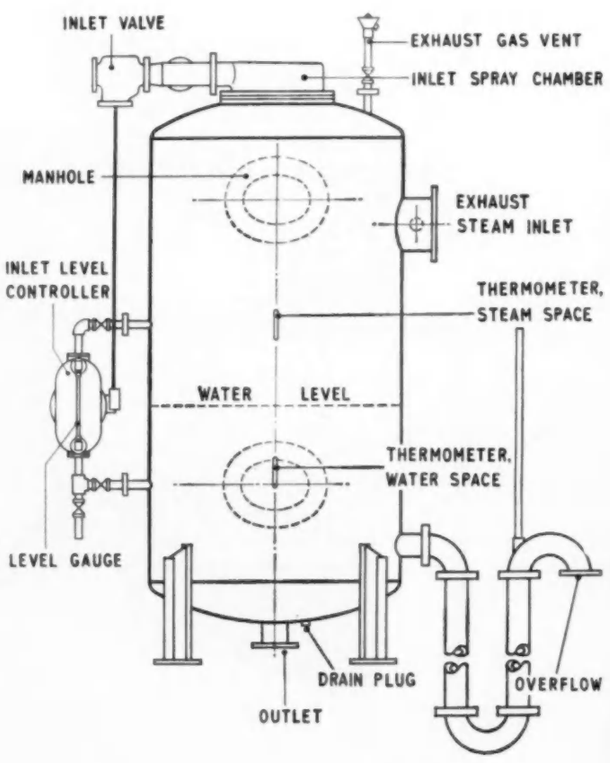
Permutit De-aerators remove oxygen from feedwater

Oxygen causes corrosion in boilers and feedwater systems. This must lead to financial losses that can be serious. Permutit De-aerators eliminate oxygen from feedwater and provide the complete answer to this corrosion problem.

Permutit De-aerators are highly efficient. Oxygen is removed by a double stage process of spray heating in a steam blanket, and reboiling in a steam scrubber: residual oxygen is thereby reduced to 0.005 cc per litre or less. **They operate on exhaust steam, and running costs are negligible:** all the heat in the steam is recovered and returned to the feed system.

Permutit De-aerators are used all over the world: shown opposite is the boiler house at the Coryton Oil Refinery of the Mobil Oil Company, where a Permutit De-aerator treats all the boiler feed.

For full information on Permutit De-aerators and other forms of water treating equipment, write to the address below.



Diagrammatic arrangement of a typical Permutit De-aerator.

BY APPOINTMENT SUPPLIERS OF WATER TREATING EQUIPMENT TO THE LATE KING GEORGE VI

THE PERMUTIT COMPANY LIMITED

DEPT. T.F.12, PERMUTIT HOUSE, GUNNERSBURY AVENUE, LONDON, W.4

TELEPHONE: CHISWICK 6431 WORKS: EALING AND SOUTH WALES CABLES: PERMUTIT, LONDON

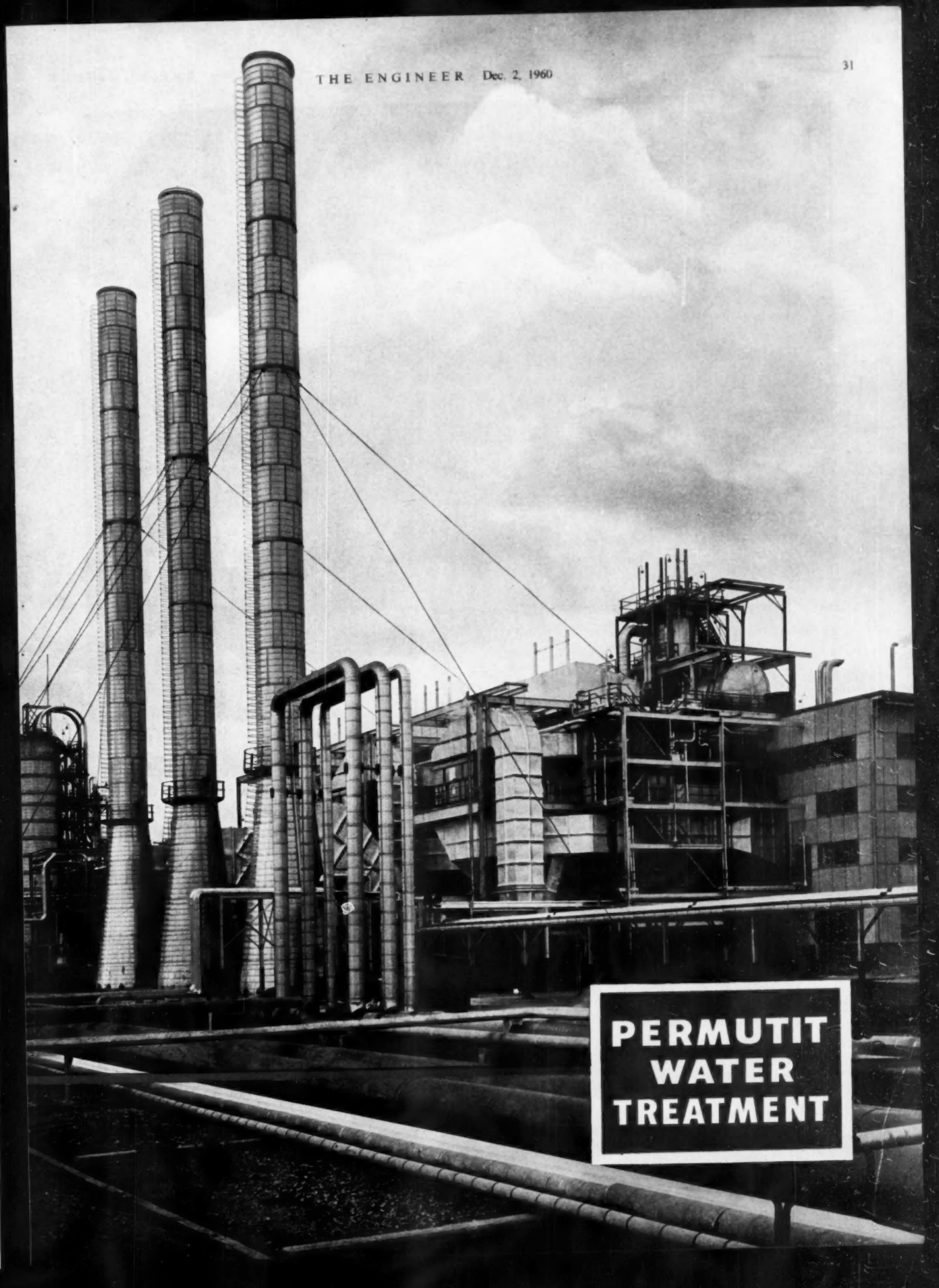
SUBSIDIARIES:

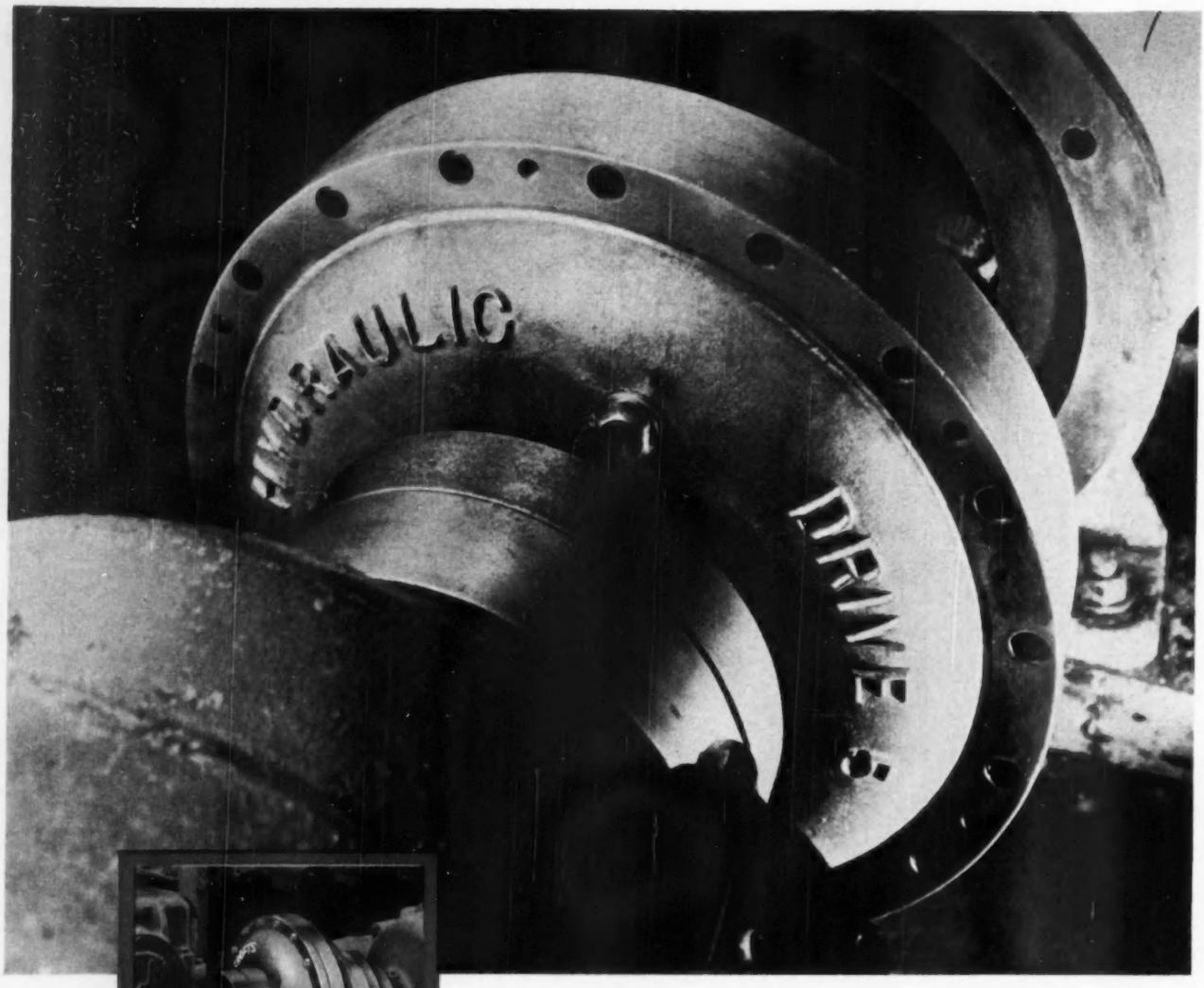
THE PERMUTIT COMPANY OF AUSTRALIA PTY LIMITED
P.O. Box 21, Brookvale, New South Wales

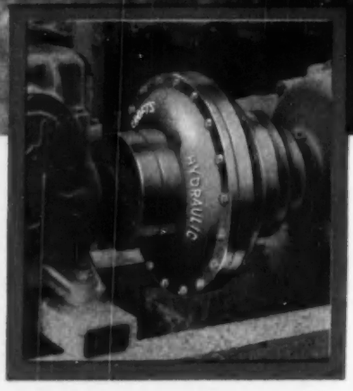
THE PERMUTIT COMPANY OF SOUTH AFRICA (PTY) LTD.
P.O. Box 6937, Johannesburg

ION EXCHANGE (CANADA) LTD., 33 Price Street, Toronto 5, Ontario • UNITED WATER SOFTENERS LTD., Gunnersbury Avenue, London, W.4

Enter No. 301 on reply card


PERMUTIT
WATER
TREATMENT





cushioned running

ALL ALONG THE LINE!

That's your production line when you use Crofts Patent 'Free-Space' Hydraulic Couplings and Drives. For smooth, controlled acceleration to full speed and cushioned stall-proof drive you can't beat 'em. When you think of hydraulic couplings and you need easy fitting, quick alignment, neater arrangement and reduced driving costs, there's only one answer—Crofts 'Free-Space' Hydraulic Couplings and Drives—they're unbeatable. And every drive is *guaranteed!*

STANDARD RANGE FROM ½ h.p. at 1440 r.p.m. TO 700 h.p. at 875 r.p.m.

Send today for publication 460TE

Crofts

CROFTS (ENGINEERS) LIMITED

POWER TRANSMISSION ENGINEERS

THORNBURY, BRADFORD 3, YORKSHIRE

Tel: 65251 (20 lines) Grams: 'Crofters Bradford Telex' Telex 51186

BRANCHES AT: Belfast Birmingham Bristol Cardiff Dublin Glasgow Ipswich Leeds Liverpool London Manchester Newcastle Northampton Nottingham Sheffield Stoke-on-Trent

Subsidiary Companies in Canada, South Africa, U.S.A. *World-wide representation*

For EX-STOCK service in BIRMINGHAM ring ASTon Cross 4471/2

Enter No. 321 on reply card

PACKAGED escalators

from J. & E. Hall

The only British-built packaged escalator, constructed by the largest manufacturers of escalators for stores, commercial and public buildings, and backed by 30 years' experience.

Passes through 10 ft. opening, cuts actual installation time to approximately 3 days, and ensures the minimum of interruption to normal business arrangements.

J. & E. Hall's escalator engineers are at all times at your service to discuss all aspects of escalator planning, installation and operation.

J & E HALL LTD

A Member of the Hall-Thermotank Group

DARTFORD · KENT Tel: Dartford 23456

London Office:

10 St. Swithin's Lane, E.C.4. Tel: MANsion House 9811

Enter No. 331 on reply card

D

THE SPACEMAN
and the Hostess...

Satellites and Saucepans, Nose Cones and Candlesticks, from the inhospitable inky blackness of outer space to the welcoming, softly illuminated Dinner Table, "Staybrite" Stainless Steels are playing their part. Spacebound or Earthbound, the versatility of these special Steels opens up new realms of exploration, where the research and production techniques of Firth-Vickers will continue to lead the way.

FV STAINLESS STEELS

FIRTH-VICKERS STAINLESS STEELS LTD., SHEFFIELD
– the only Company in Europe to devote its activities exclusively to the production and development of stainless and heat-resisting steels.
Enter No. 341 on reply card

TEAM WORK-

IT'S TEAM WORK THAT COUNTS—

team work all the way through, from the inception to the finishing processes. In all the intermediate stages of production, Weathershields can help you, by co-operation in design, development, manufacture and service, to solve your bottle-neck problems and maintain maximum output.

Team up with Weathershields and keep things moving.

PRESS WORK, FABRICATIONS, SHEET METAL WORK, WELDING, GLAZED UNITS.

LIGHT ENGINEERING DIVISION

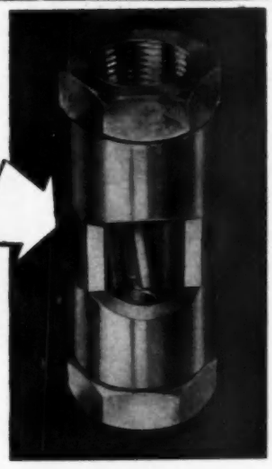
Weathershields LTD

BISHOP ST, BIRMINGHAM 5. MID 5876

THE NAME YOU KNOW

Enter No. 351 on reply card

See the flow with the 'Telicator'



Both low and high pressure systems can be fitted with a Telicator Visual Flow Indicator, which is a simple instrument for indicating the flow, whatever the viscosity. The rotors are specially designed by Dukes and Briggs to give the clearest indications over specific ranges of flow rate. Water supplies for cooling purposes and forced lubrication systems are two typical applications. A new model is under development for use with opaque fluids, and special designs can be made to meet specific requirements.

Note these features

- *Simple design ensures complete reliability.*
- *Extreme sensitivity at all pressures.*
- *Units readily adaptable to existing installations.*
- *May be mounted in any plane.*
- *Comparative flow gauged by speed of revolving rotor.*

Bailey's REGD.

SIR W. H. BAILEY & CO. LTD. HEAD OFFICE AND EXPORT SALES: ALBION WORKS, PATRICROFT, MANCHESTER. TEL: Eccles 3487 (4 lines)
LONDON AND SOUTHERN AREA SALES: SELINAS LANE, DAGENHAM, ESSEX TEL: DOMINION 2277 (3 LINES)

Enter No. 352 on reply card

Streamlined SERVICE

*BECAUSE we have equipped and staffed our organisation technically and specifically to deal with **all** the problems of modern metal cleaning, we are able to provide the right process and the right product to meet any unusual requirement. Consultation with "S.A.C." technicians is the streamlined way of getting the **answer** which saves you time and cost.*

PRODUCTION PROVED PRODUCTS

SUNBEAM ANTI-CORROSIVES LTD.

CENTRAL WORKS · CENTRAL AVENUE
WEST MOLESEY · SURREY

Telephone: Molesey 4484 (5 lines)
Telegrams: Sunanticor, East Molesey

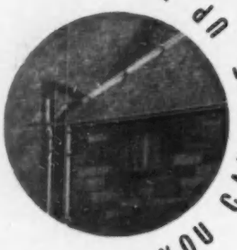
Manufacturers of
STRIPALENE · FERROCLENE · ALOCLENE · FERROMEDE · BRAZOCLENE
(Regd. Trade Marks)

APPROVED BY ADMIRALTY, WAR OFFICE AND AIR MINISTRY

Enter No. 353 on reply card

SORTS OF THINGS WITH GIBSON

UP TO ALL



YOU CAN GET

John Gibson and Son have spent many years in getting up to all sorts of tricks to enable people to get up to all sorts of things in all sorts of places. Unserviceable lighting fittings, broken windows — ventilation systems — any one of a thousand awkward overhead maintenance jobs are brought within easy reach by a GIBSON tower ladder. GIBSON towers can be trailer or hand towed or fitted with an electro-drive to travel at normal walking pace. Hand winch operated and of rigid aluminium construction, they tackle the most difficult jobs with characteristic GIBSON efficiency and ease of operation. Why not write for descriptive leaflets and get the fullest information.

GIBSON

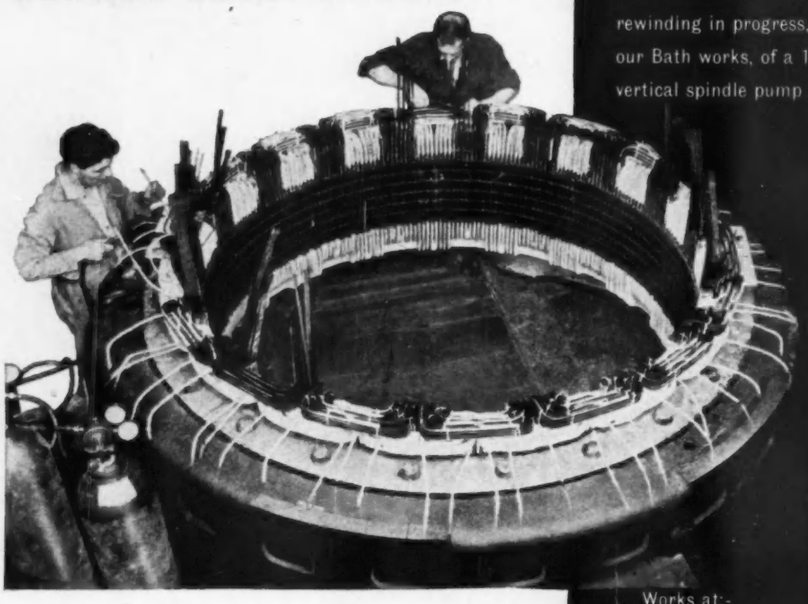
JOHN GIBSON & SON LIMITED,
JAMESON PLACE, LEITH, EDINBURGH, 6.
(Established 1898)
'Grams: "Aero" Edinburgh
Tel: Leith 35418 (4 lines)
Distributors: Beresford Atkinson Ltd., Hough Hall Road, Manchester, 10. Tel. Collyhurst 2991 Municipal Supplies Ltd., 2 Robert Street, Adelphi, London, W.C.2. Tel. Trafalgar 5401. A

Enter No. 361 on reply card

B.E.R.L *Rewinding to any specification*

of armatures, stators, rotors, field coils and transformers. The illustration shows rewinding in progress, at our Bath works, of a 1320 h.p. vertical spindle pump motor.

REWINDS LARGE OR SMALL



Works at:-
Bath
Birmingham
Cardiff
Chesterfield
Edinburgh
Glasgow
Hawick
London
Manchester
Newcastle upon Tyne
Swansea

BRITISH ELECTRICAL REPAIRS LIMITED

Head Office: Empire House, Charlotte Street, Manchester 1
Telephone: CENtral 1378 and 3641

dm. BER. 129.

Enter No. 362 on reply card

IRONSIDES LUBRICANTS

IRONSIDES SHIELD PRODUCTS

Keeps 'em rolling!

THE IRONSIDES LUBRICANTS LTD
DAW BANK · STOCKPORT · CHESHIRE

Enter No. 363 on reply card

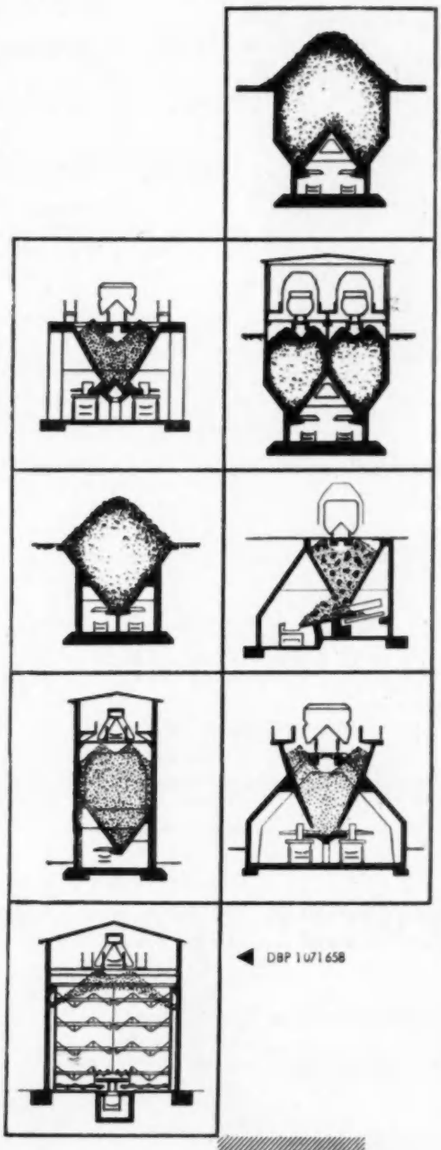
Steel and Spheroidal Graphite Iron

CASTINGS

also **HIGH QUALITY ENGINEERING**
and MACHINE TOOL GREY IRON
CASTINGS UP TO 10 TONS

R. GOODWIN & SONS (ENGINEERS) LTD.
Ivy House Foundry · Hanley · Stoke-on-Trent
Staffs. *Tel.:* Stoke-on-Trent 23612

Enter No. 364 on reply card



◀ DBP 1071658

Fully-automatic

BUCKAU-WOLF

Slot Bunker and Blending Bunker Plants with discharge carriage

(German and foreign patents)

for hard coal, brown coal, briquettes, coke, peat, limestone, ores, dolomite, stone, soil, spoil etc.

No arching of material over bunker discharge opening.

No bunker gates, pockets or pile-ups.

Completely automatic discharge, both over the entire length or within any desired sections of the bunker.

Infinitely variable control of delivery rate within wide limits.

Materials can be blended to suit requirements.

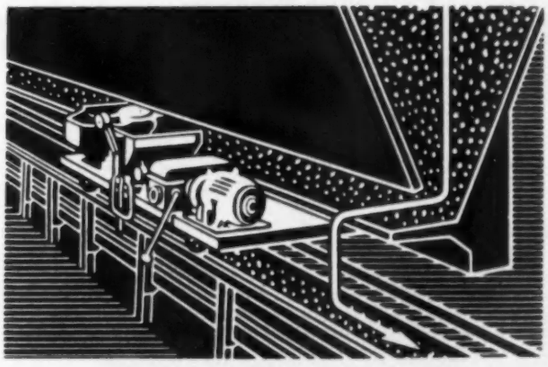
Delivery rate and blending ratios can be remote controlled.

Minimum maintenance, maximum dependability.

Simple design makes for easy operation.

Low capital outlay.

Performance-proved since 1922
BUCKAU-WOLF Discharge Carriage

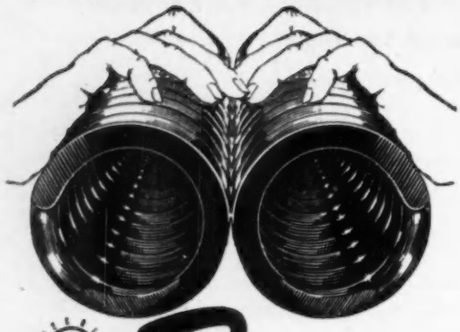


You may confidently let us in on your particular bunkering problems. The wealth of our experience in the construction of slot bunkers with discharge carriage having rotating scraping tools and the related conveying, crushing and screening plants is gladly at your disposal.

MASCHINENFABRIK BUCKAU R. WOLF
AKTIENGESELLSCHAFT · GREVENBROICH-NEUSS
(WESTERN GERMANY) ABE 015e

Enter No. 371 on reply card

Looking in the right direction

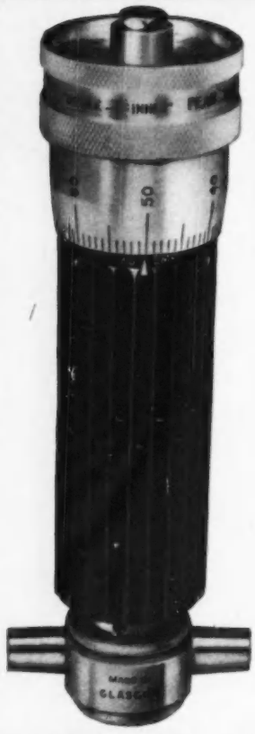


Ratcliffe

SPRINGS

F. S. RATCLIFFE (ROCHDALE) **LTD.,**
Crawford Spring Works, Norman Road, Rochdale
'Phone: Rochdale 40415 'Grams: "Recoil" Rochdale. Telex 63178
CW5968

Enter No. 381 on reply card



PEAK PRESSURE INDICATOR

Peak and compression pressures are shown automatically and clearly.
Here is the ideal indicator for regularly checking engine cylinder pressures. A valuable aid to the service or maintenance engineer and a most useful accessory in the Test Shop.
Static calibration is accurate; graduations may be in p.s.i. or kg./cm².

To 1500 p.s.i. for cylinder pressures, and 15000 p.s.i. for fuel oil pressures.

DOBBIE McINNES LTD

Nautical and Engine Room Instruments

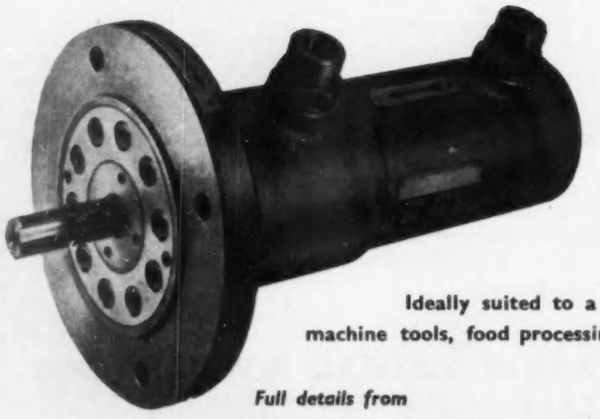
191-3 BROOMLOAN ROAD GLASGOW, S.W.1
London · Liverpool · South Shields

Enter No. 382 on reply card

»TECHNOIMPEX« BUDAPEST

OUR NEWEST SCREWPUMPS

- **High efficiency**
- **Great durability**
- **Maintenance Free Operation**
- **Uniform delivery**
- **Flanged and base mounted designs**



Various Models

Max pressure :	140 - 2500 p.s.i.
Capacity :	0.4 - 90 galls/min.

Models also available incorporating heating jackets for pumping viscous liquids.

Ideally suited to a wide range of hydraulic machinery, machine tools, food processing and chemical plant etc.

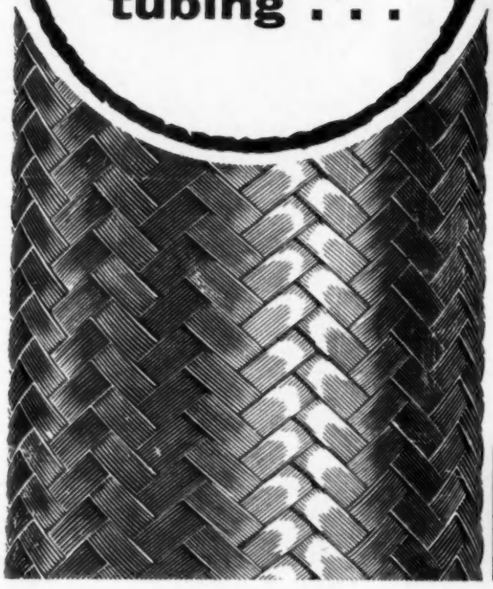
Full details from

J. H. LITTLE (Traction and Engineering) Ltd.
51-52 BARBICAN, LONDON, E.C.I. *Tel :* MONARCH 6124

Sole U.K. Agents for Screw Pumps exported by
TECHNOIMPEX HUNGARIAN MACHINE INDUSTRIES FOREIGN TRADE COMPANY
P.O.B. 183, Budapest, 62.

Enter No. 383 on reply card

To produce this braided 5" diameter tubing . . .



. . . this machine requires 1300 MILES of Austenitic Stainless Steel Wire of any gauge each week

Photo by courtesy of Messrs. B. & F. Carter & Co. Ltd., Bolton, Lancs

For the best results . . .

and trouble-free operation on these and other machines—you are recommended to use our AUSTENITIC STAINLESS STEEL WIRE which can be drawn to your own Specification or those mentioned alongside.

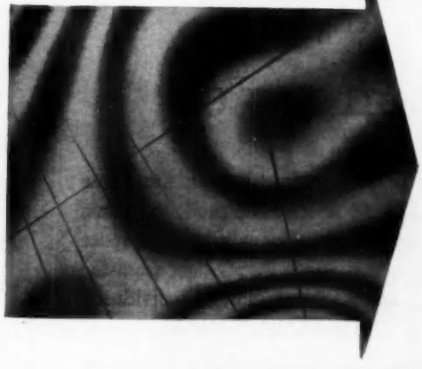
We can cover all your requirements and specifications to include . . .
DTD 189 · DTD 489 · DTD 549 · DTD 571
DTD 734 · DTD 2002 · BS 2056 · BS 1554
BS 1453 · W 10 · W 11 · E 20 · AISI 302
AISI 304 · AISI 316 · AISI 321 · AISI 347
or to your own specifications. AID and ARB approved.

STAINLESS STEEL WIRE COMPANY LIMITED

The Barracks, Langsett Rd., SHEFFIELD 6.
Phone: 344241/2 Grams: "Finewyre" Sheffield

Enter No. 391 on reply card

Tinsley



strain gauges

Electrical wire resistance strain gauges are accepted by engineers as one of the most important means of investigating stresses and strains in all types of structures and machines. The electrical resistance strain gauge consists of a grid of fine wire bonded to a paper or Araldite membrane which can be cemented to the surface under investigation. Connections are taken from the gauge to apparatus designed to give reliable and quick readings of the strain being measured.

Tinsley strain gauges are available in various designs & materials to meet individual requirements within three broad temperature ranges :—

Standard strain gauges.....70°C Max.
Medium temp. gauges.....300°C Max.
High temp. gauges.....700°C Max.

A range of measuring instruments can be supplied for indicating and recording static strains.

Write for Lists 210 and 210A, giving full particulars of Tinsley strain gauges and associated measuring apparatus.

H. TINSLEY & CO. LTD. WERNDEE HALL, SOUTH NORWOOD, LONDON S.E.25
Telephone: ADDiscombe 6046-7-8

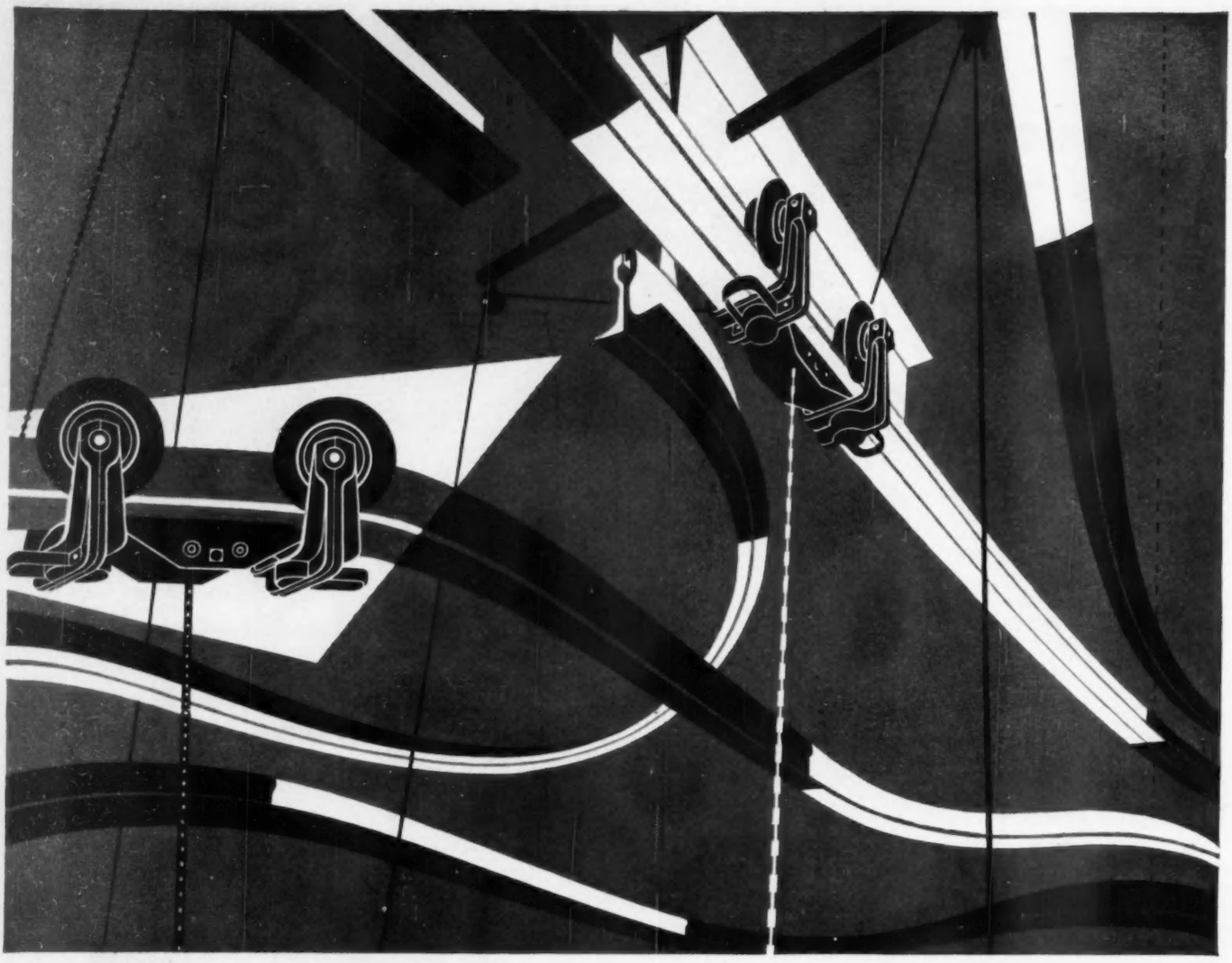
Enter No. 392 on reply card

. . . then the name that SPRINGS to mind is . . .

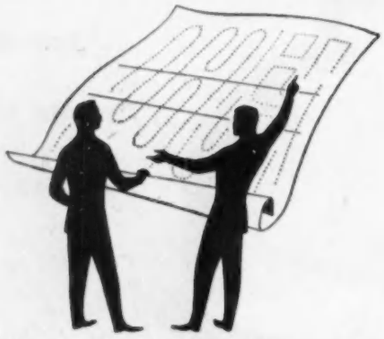
M. LYNCH & SON LTD
MILL WHARF, CANAL ROAD, STROOD, KENT
TEL. STROOD 75456 GRAMS LYNCH STROOD

MERCHANTS & SUPPLIERS • STOCKHOLDERS OF STRUCTURAL STEEL

Enter No. 393 on reply card



OVERHEAD is the open road



After a survey of your plant, we produce a tailor-made plan. This and the estimate are free.

Whether simply transferring raw materials from unloading bays to stores, or routeing components at a pre-controlled rate along an involved production line, the MonoRail system allows unrestricted movement. It saves valuable floor space and permits transit over otherwise-congested areas. Each installation, from the smallest gravity drive to the most complex automated system, is individually tailored to your requirements.

Advantages worth noting □ Uses 'free space' for conveyance and storage □ Switches, interlocks and lifts permit movement in three dimensions □ Choice of individually powered, fully automated or gravity drives □ Can accommodate any number of items per transit □ Transit rates from 2-150 ft./min. □ Negligible operational and maintenance costs □ Underslung system permits unobstructed transfer between parallel tracks □ System can be extended as required □ Any size of installation □ Excellent after-sales service

Please write for information on our Underslung Stacker Crane

Send for the man with the MONORAIL plan

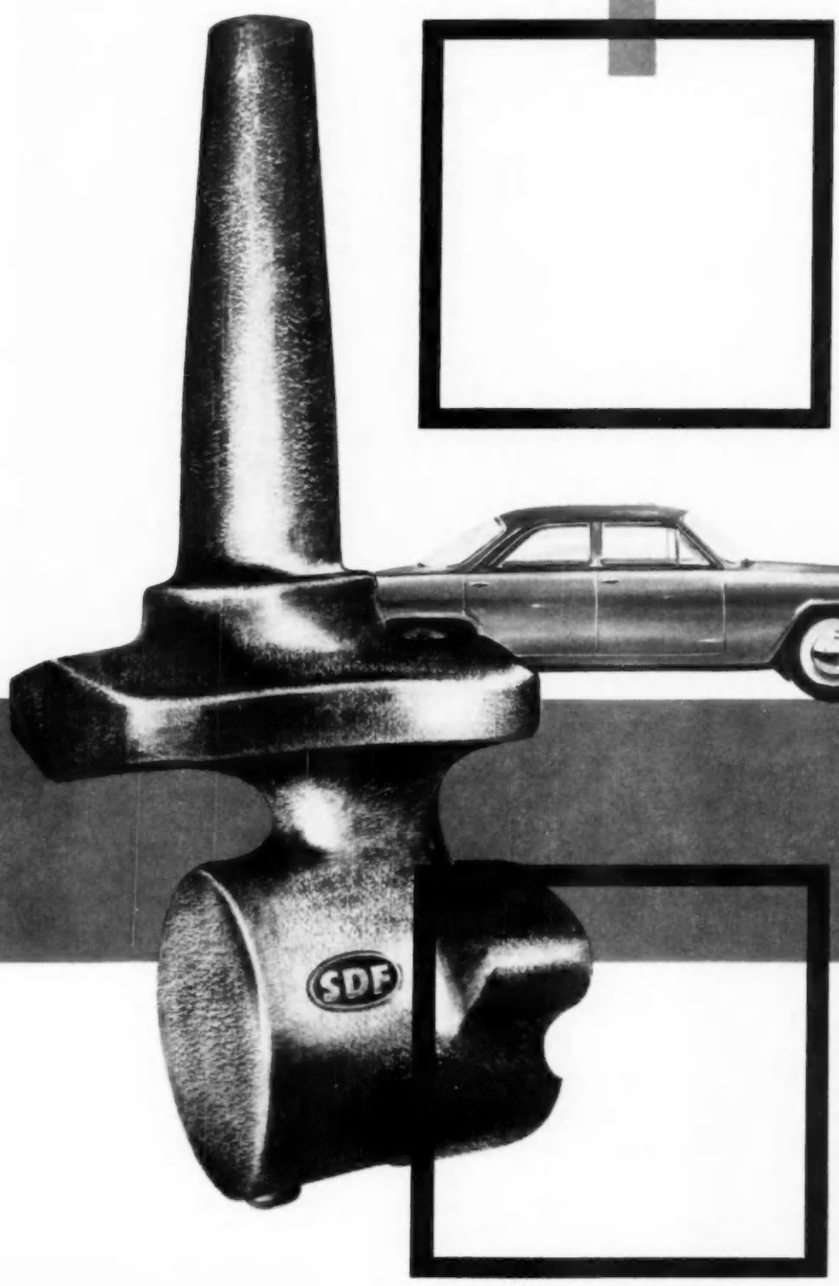
BRITISH MonoRail LIMITED

WAKEFIELD ROAD · BRIGHOUSE · YORKS · TELEPHONE : BRIGHOUSE 2244

A Member of the Herbert Morris Group of Companies

TGA/BM1

Enter No. 401 on reply card



Advanced techniques
and reliable service
have established for
Smethwick Drop Forgings
a fine reputation

The stamp of quality

SDF

SMETHWICK DROP FORGINGS LTD · SMETHWICK & KIDDERMINSTER

Enter No. 411 on reply card

Severn

E

New Melting Shop for English Steel Corporation Ltd., Sheffield.

Steelwork for Industrial Buildings

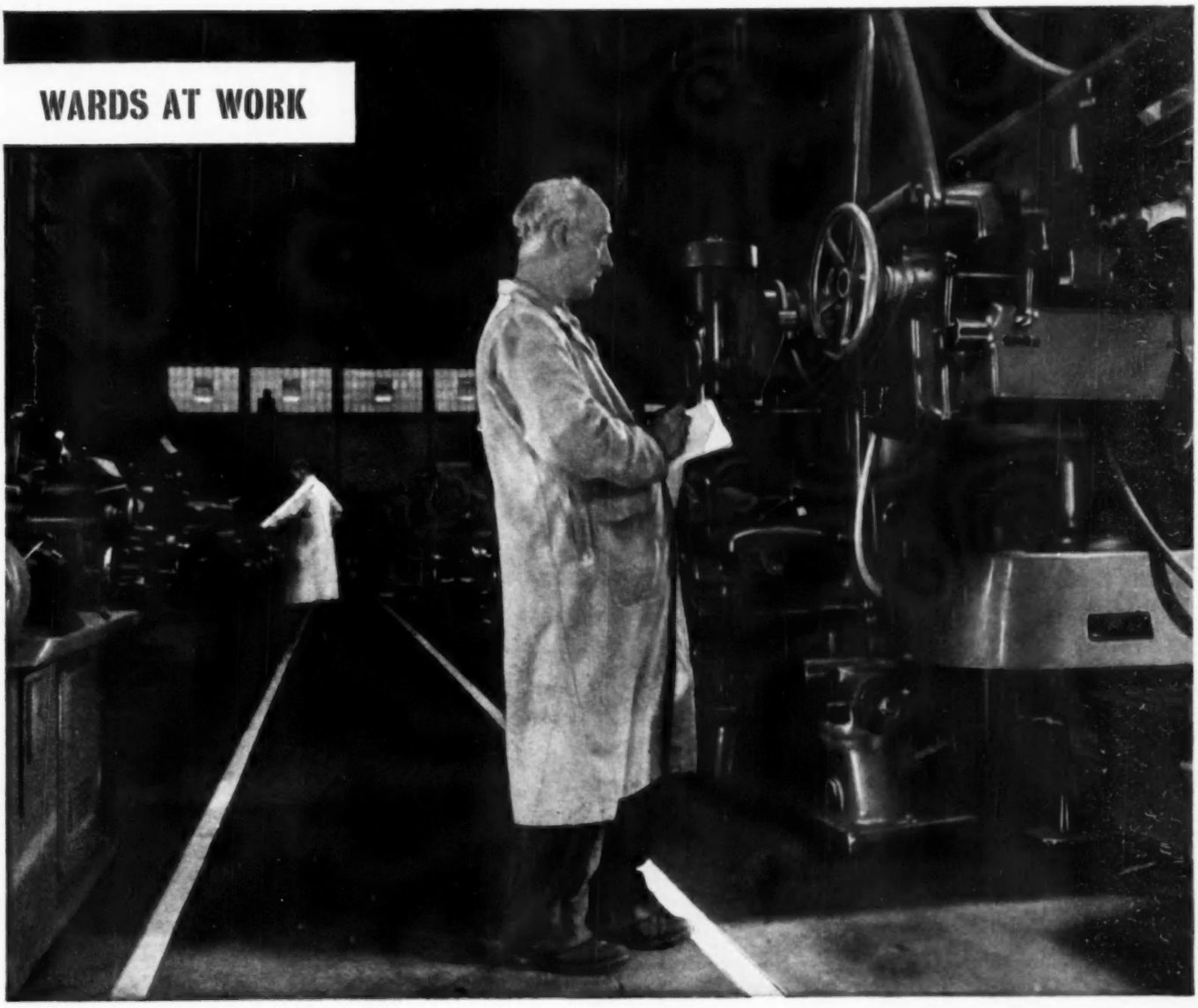
Illustrated are two recent examples of heavy structural steelwork supplied and erected by ARROL. These form part of a long record of industrial development which can be traced from the ARROL order books

Extension to melting shop of William Beardmore & Co. Ltd. Overhead Electric Crane also supplied by ARROL.

SIR WILLIAM ARROL & CO LTD GLASGOW

Arrol

Enter No. 421 on reply card



He stocks everything from a drill to a drop stamp!

If you're looking for a drill, a diesel engine or a drop stamp . . . a pump or a press . . . a planer or a plating plant—he's the man to help you. He's on the staff of Ward's Machinery Department—one of the biggest and most comprehensive organisations in the country, dealing with new, rebuilt and second hand equipment, with showrooms at Sheffield, Silvertown, Glasgow and Briton Ferry. Used machinery offered is checked and overhauled where necessary in Wards workshops where a high reputation for performance and keen value has been maintained for more than seventy years.

Sales of new, rebuilt and used plant and machinery are among the many activities of the Ward Group of Companies whose products and services cover almost every branch of industry.

Serving Industry Around The World

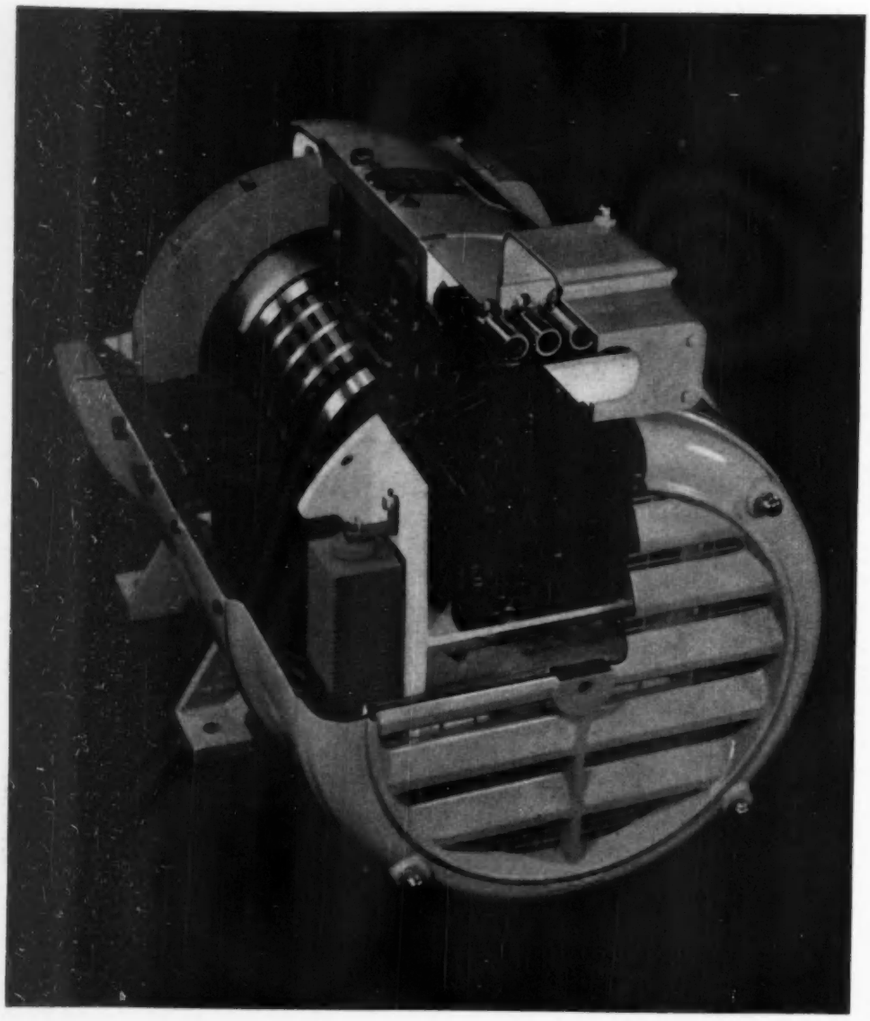
THOS. W. WARD LTD

Head Office: ALBION WORKS, SHEFFIELD.

London Office: BRETTENHAM HOUSE, STRAND, W.C.2.

G.P. 95

Enter No. 431 on reply card



a germinal idea in alternator design... the STAMFORD principle

STAMFORD

By dispensing with any form of rotating exciter, the Stamford principle makes possible a drastic reduction in the weight, complexity and cost of each unit. Troublesome commutators, and D.C. brushes are replaced by static control gear with resultant long life and improve the regulation at all power factors.

Five types of Stamford Alternator* are available, giving the ideal machine for every application. Outputs range from 500w to 300KVa. For accurate voltage regulation and high transient overload capacity for motor-starting duty, rapid recovery on change of load and regular wave form, specify Stamford Alternators.

* STAMFORD E.S.
* STAMFORD STANDARD
* STAMFORD NEWPHASE
* STAMFORD L RANGE
* STAMFORD MARINE RANGE

Simple construction for long life

High output : weight ratio

All machines tropically impregnated

Unimpeded air stream means efficient ventilation (1) D.C. brushes and commutator eliminated (2)

Static control gear for complete reliability (3) and close regulation (4)

NEWAGE GROUP

The symbol of the Newage group is the hall-mark of first-class engineering

Alcon Thames range of centrifugal pumps
Alcon Self Priming Pumps

ARTHUR LYON & CO. (ENGINEERS) LIMITED

Head Office and Home Sales: Park Works, Stamford, Lincs. Stamford 2552 (9 lines). Telegrams: "Arleoco" Stamford
Export Sales: 6 Carlos Place, Grosvenor Sq., London, W.1. Hyde Park 9141. Cables: "Newapower" Audley, London.

Enter No. 441 on reply card

The NEW Blakeborough

POWER CHECK VALVE

A power-assisted, quick-closing non-return valve for turbine bled steam lines, delivery lines from compressors, etc, where instant response with freedom from risk of sticking is essential. In addition to its positive, extra-rapid closing feature, this valve has important advantages over previous types in the way of compactness, reliability, and economy. Available in all required sizes from 2 in. upwards, for pressures up to 450 psi. and temperatures up to 900 F.

BLAKEBOROUGH

For further details see publication 241, free on request.

J. BLAKEBOROUGH & SONS LIMITED BRIGHOUSE ENGLAND

Enter No. 451 on reply card

It takes him 60 minutes* to assemble 100 ¼" full nuts and jam nuts

It takes him 40 minutes* to assemble 100 ¼" Nyloc self-locking nuts!

By using one ¼" Nyloc self-locking nut instead of a full nut and a jam nut you could save 20 minutes and approximately 2/- on every hundred assemblies. On some jobs, Simmonds self-locking nuts could save many a company *up to £2,000 a year!* Why not call in Simmonds to carry out a completely thorough costing of your present assembly methods? *Our 16mm Nyloc colour film is available for showing in your factory.*

time saved is money saved **SIMMONDS SELF-LOCKING NUTS**

* *All times shown are based on "The Handbook of Standard Time Data for Machine Shops" by Haddon & Genger, published by Thames & Hudson Limited, London.*

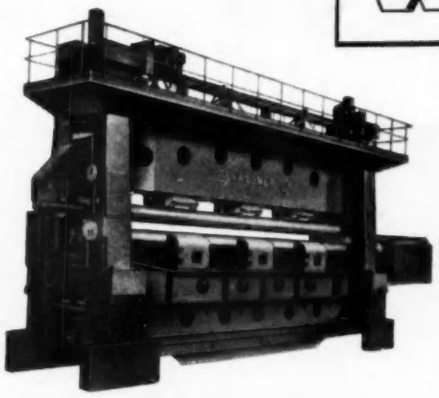
SIMMONDS AEROCESSORIES LIMITED · TREFOREST · PONTYPRIDD · GLAMORGAN A MEMBER OF THE FIRTH CLEVELAND GROUP

CRC 41N

Enter No. 461 on reply card

modern shipbuilding equipment by

WAGNER
OF DORTMUND



WAGNER

SHIP & MARINE ENGINE BUILDING MACHINES

SHIP PLATE BENDING MACHINES
with or without pre-bending.

HYDRAULIC BENDING MACHINES
from 160 tons.

THREE-ROLL BENDING MACHINES
with or without pre-bending.

FOUR-ROLL BENDING MACHINES
for plates from $\frac{3}{16}$in. thick.

SHIP RIB BENDING MACHINES
for sections up to 16in. thick.

ROLLER SECTION BENDING MACHINES
with or without pre-bending.

Please let us demonstrate to you.

PLATE STRAIGHTENING MACHINES
for plates $\frac{3}{16}$in. thick.

DOUBLE STANDARD PLATE SHEARS
for plates from $\frac{3}{16}$in. thick.

CIRCULAR CUTTER SHEARS
for plates from $\frac{3}{16}$in. thick.

CIRCULAR CUTTER TRIMMING SHEARS
for trimming both sides and slitting plates from $\frac{3}{16}$in. thick.

ROLL SHEARS
also with planing attachment for plates $\frac{3}{16}$in. thick.

PLATE EDGE PLANING MACHINES
with rack or screw drive, cutting power from 1·2 tons.

PUNCHING MACHINES
from 160 tons.

LEVER PUNCHING MACHINES AND SHEARS
single and combined, from 160 tons.

WATER HYDRAULIC AND OIL HYDRAULIC SHIPBUILDING PRESSES
from 160 tons.

OIL HYDRAULIC STRAIGHTENING AND BENDING PRESSES
from 125 tons.

MECHANICAL STRAIGHTENING AND BENDING PRESSES
from 200 tons.

HYDRAULIC PRESS BRAKES
from 160 tons.

MECHANICAL PRESS BRAKES
from 200 tons.

SINGLE STANDARD ECCENTRIC PRESSES
single and double sided from 200 tons.

DOUBLE STANDARD CRANK PRESSES
from 200 tons.

JOGGLING AND FLANGING PRESSES
from 200 tons.

HYDRAULIC RAPID FORGING PRESSES
from 200 tons.

STEAM AND PNEUMATIC HAMMERS

VAUGHAN ASSOCIATES LIMITED

4 QUEEN STREET · CURZON STREET · LONDON · W.1 Tel: GROsvenor 8362

Midland Office and Demonstration Room: **WILFORD CRESCENT · NOTTINGHAM** Tel: NOTT 88008

Rainbow 1556

Enter No. 471 on reply card

ROSE'S EXPANSION PIECES

PRESSED STEEL BELLOWS TYPE IN MILD AND STAINLESS STEEL

Enquiries solicited Send for Booklet

also AIR RECEIVERS, CHIMNEYS, TANKS, PIPE WORK, PRESSURE CYLINDERS, AND FABRICATED STEEL PLATEWORK

BRITISH APPLIANCES MFG. CO., LTD.

DOLLY LANE, LEEDS, 9

Telephone 30725 Telegrams: STRUCTURAL LEEDS 9

Enter No. 472 on reply card

TRADE Smedley MARK

PAN GRINDING MILLS

REVOLVING OR STATIONARY PANS
PERFORATED OR SOLID BOTTOMS
OVER OR UNDER DRIVEN

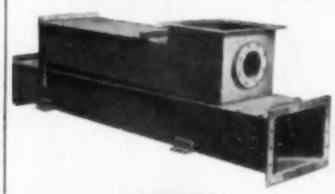
Smedley Brothers, Ltd.
Belper, Derbyshire.
Telephone: Belper 12

Enter No. 473 on reply card

CALL ON US FOR FABRICATIONS

DESIGNED, DETAILED, FABRICATED AND DELIVERED TO MEET YOUR REQUIREMENTS

General Fabrications in Mild Steel and Stainless, including Tanks, Hoppers, Chutes, Ducting, Chimneys



Staircases, Ladders, Platforms with handrailing and standards. Small Industrial Buildings

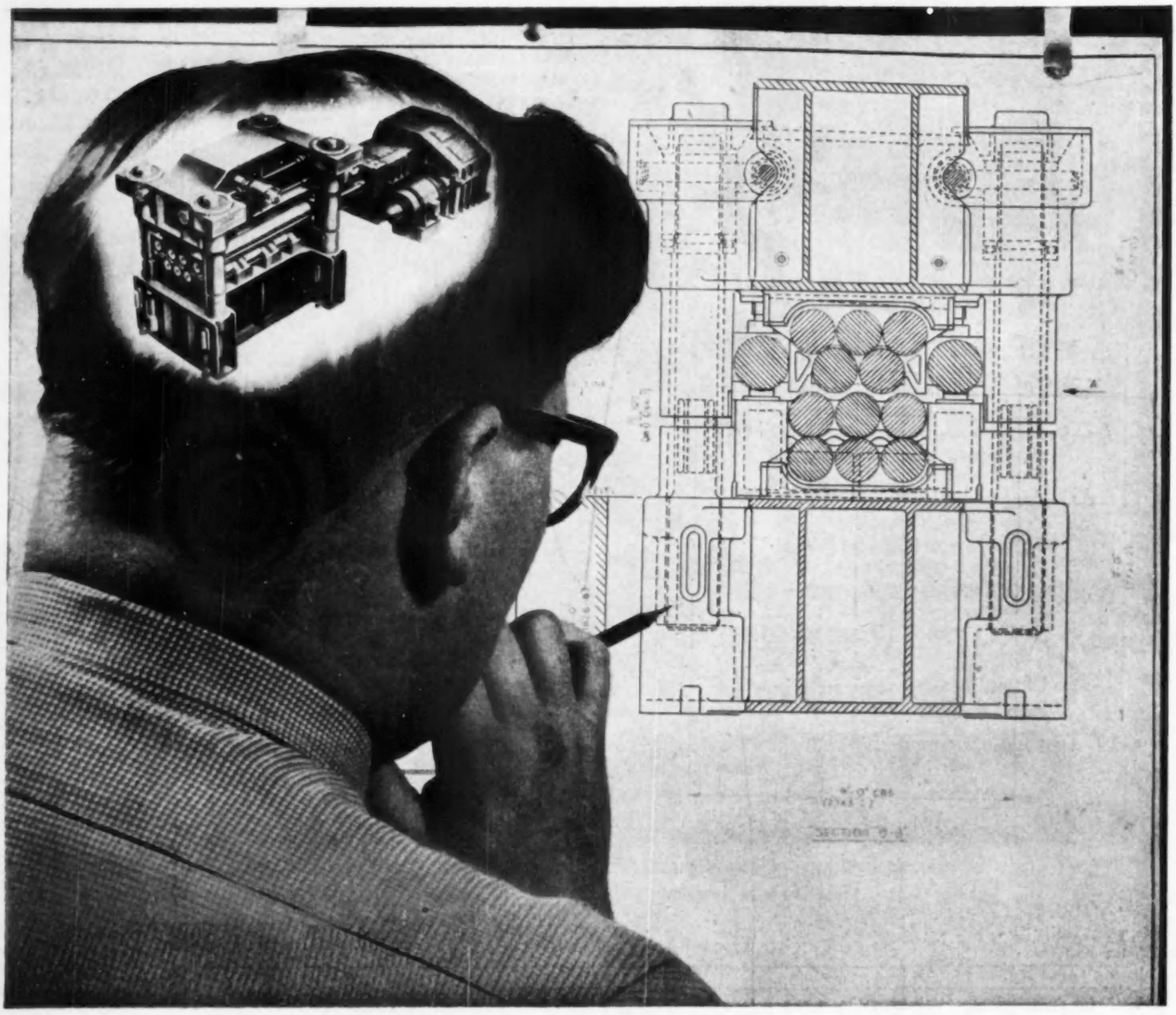
KINGSWINFORD ENGINEERING Co. LTD

2-4 BIRMINGHAM ROAD, CASTLE HILL, DUDLEY, WORCS.

Phone DUDLEY 56066

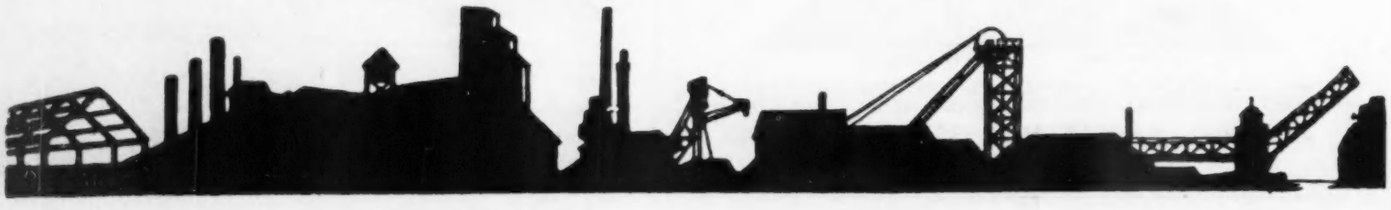
Enter No. 474 on reply card

creative

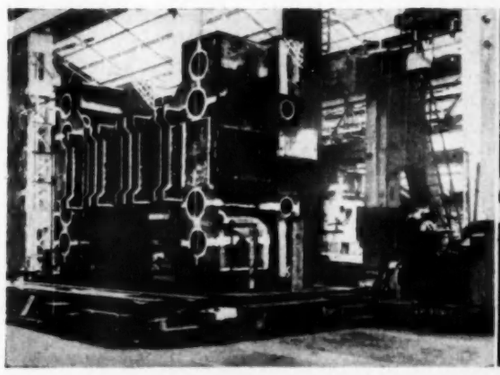


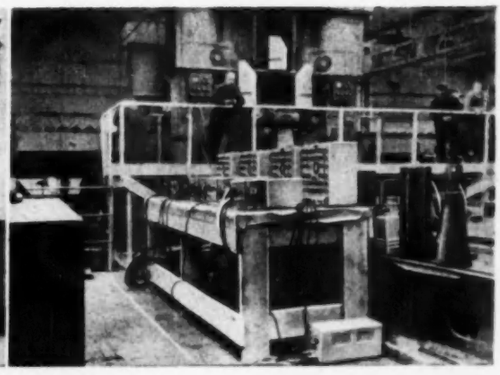
THE HEAD WRIGHTSON

COMMERCIAL STREET MIDDLESBROUGH LONDON



engineering

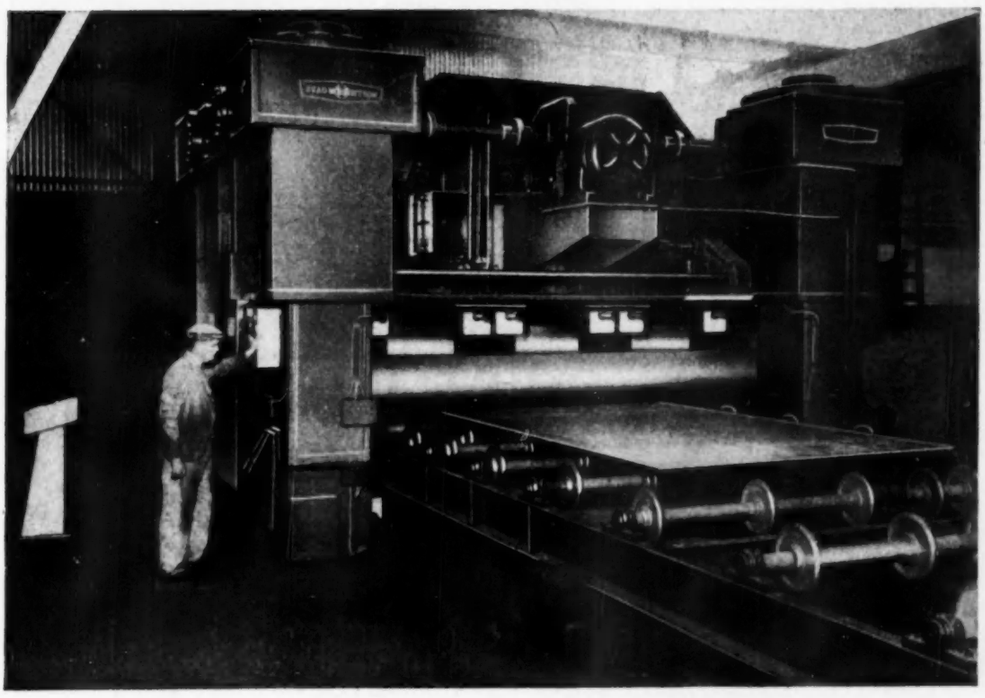




(Left) Leveller beam being machined.

(Right) The leveller undergoing fully instrumented tests prior to installation. Tests carried out with the assistance of the Group Research and Development Division.

(Below) The finished leveller installed and in operation.



Working from basic details, The Head Wrightson Machine Company Ltd. carry through the design and manufacture of capital equipment from enquiry to installation. This ability for creative engineering is well demonstrated by the Heavy Plate Leveller (to handle plates up to 2" thick by 12' 0" wide) recently installed at the Wallsend Shipyard of Messrs. Swan, Hunter & Wigham Richardson which was designed and constructed by the Head Wrightson Machine Company.

In order to build this leveller it was necessary to prepare an entirely new design in close collaboration with the Research and Development Division of the Head Wrightson Group of Companies.

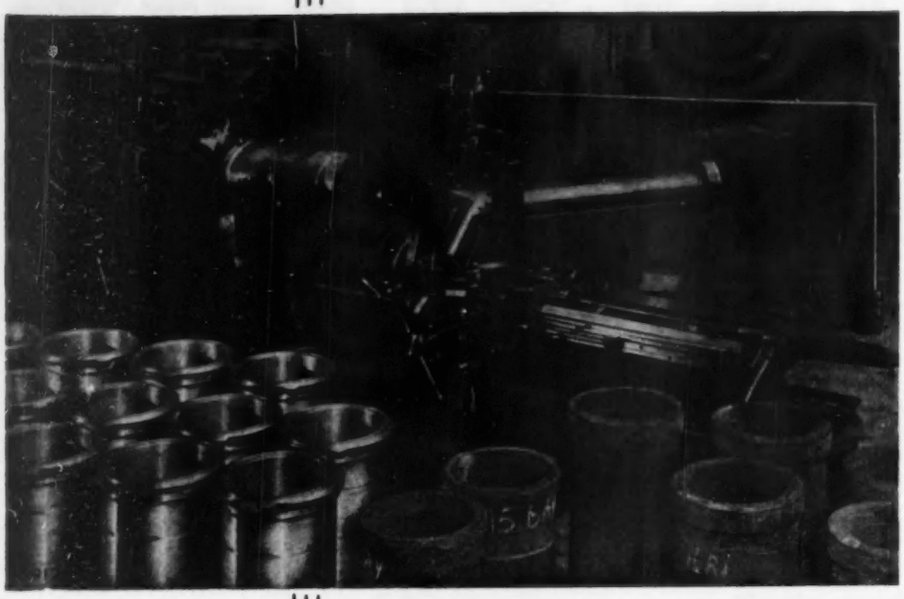
MACHINE CO LTD

JOHANNESBURG SYDNEY CALCUTTA

P 9421

Enter No. 491 on reply card

for Heavy Turret Lathe Work
the HERBERT No. 14/36 Combination Turret Lathe



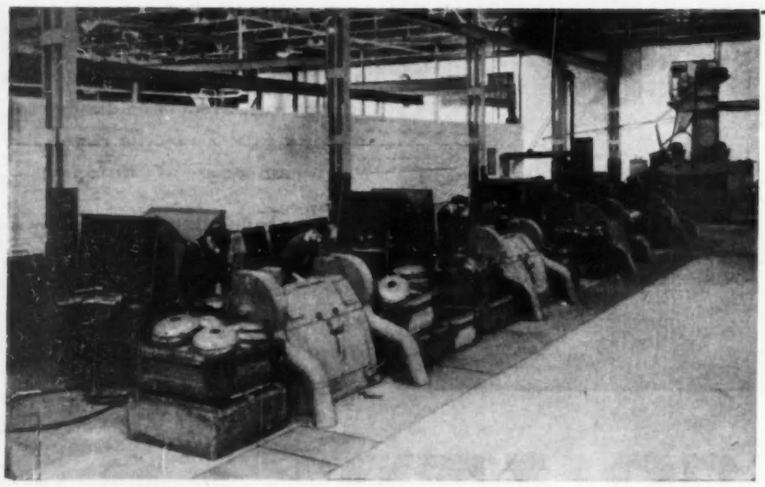
With a swing of 36in. and a drive motor of 50 h.p. it has all the advantages common to all sizes of Herbert Capstan and Turret Lathes—the power, speeds and rigidity to use carbide tools to full advantage, ease of setting up which makes for economical machining of one or two similar components, fast cutting times, high and consistent accuracy and excellent finish. Thirty-two speeds, 4 to 480 r.p.m. Sixteen reversible automatic sliding and surfacing feeds to saddle. Quick-power traverse to both motions. Chasing mechanism. Sixteen automatic feeds and quick-power traverse to turret slide. Hole through spindle, 8½in.

A Herbert No. 14/36 *Combination Turret Lathe, with special tooling for machining cylinder engine liners, installed in the Rugby Works of the English Electric Company. Machined in a total time of 5 hours, four operations. External diameters are held to* ±0·001*in., bore parallel, concentricity and ovality to* ±0·002*in.*

ALFRED HERBERT LTD., COVENTRY

AD. 324

Enter No. 501 on reply card



DUST COLLECTING

IN THE NEW DRESSING SHOP OF

THE HILL TOP FOUNDRY CO., LTD. WEDNESBURY

includes

14 "DUSTROL" (REG'D) Fettling Benches

together with Hill Top 3 speed grinders incorporating B.S.C.R.A. hoods with all ducts underground and discharging to a wet collector with automatic sludge discharge.

We can supply ANY TYPE OF COLLECTOR, WET OR DRY, and so are in a position to give unbiased advice on the best system of collection to solve your particular problem.

"DUSTROL" Fettling Benches are designed and made solely by us. . . . . .

NEWTON COLLINS LTD.

BARFORD STREET WORKS · BIRMINGHAM 5

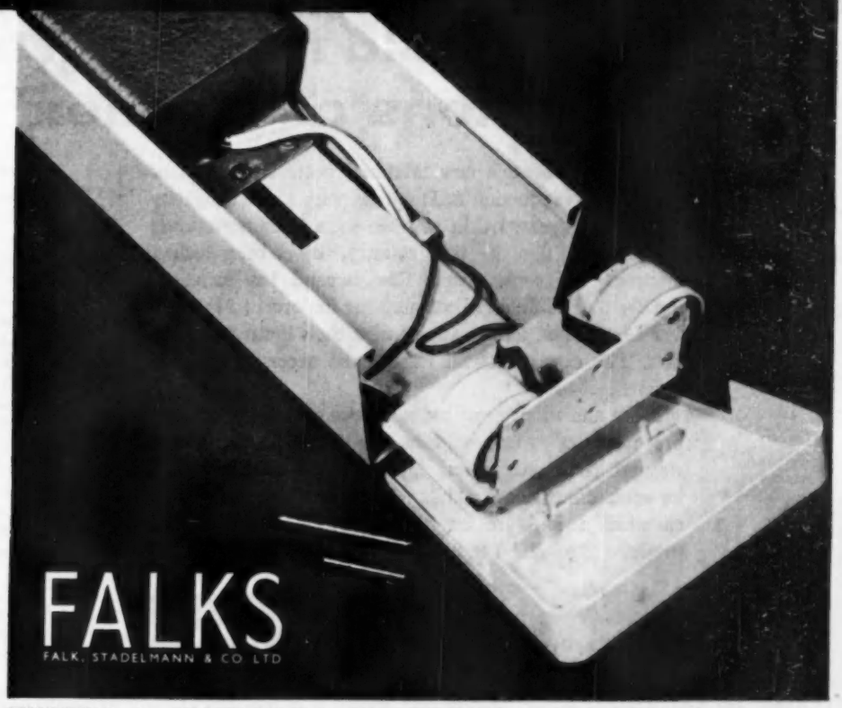
SPECIALISTS IN DUST AND FUME REMOVAL FOR NEARLY 40 YEARS

Enter No. 502 on reply card

FALKS "Summit" offers you more than 70 variations

FALKS "Summit" range embraces more than 70 assemblies with personal choice of lamping, reflector, diffuser and means of suspension. Metalwork is highly corrosion-resistant with basic channels finished in eggshell off-white and all reflecting surfaces glossy-white.

For the standard fitting for industrial lighting today and tomorrow specify FALKS "Summit" range.



THE CONTROL GEAR IS NEATLY HOUSED IN THE BASIC CHANNEL

FALKS, the long-established lighting specialists, designers and manufacturers of all types of fittings. Lighting Engineering Services freely available.

We invite your enquiries

THERE'S A MODERN FALKS FITTING FOR EVERY PURPOSE

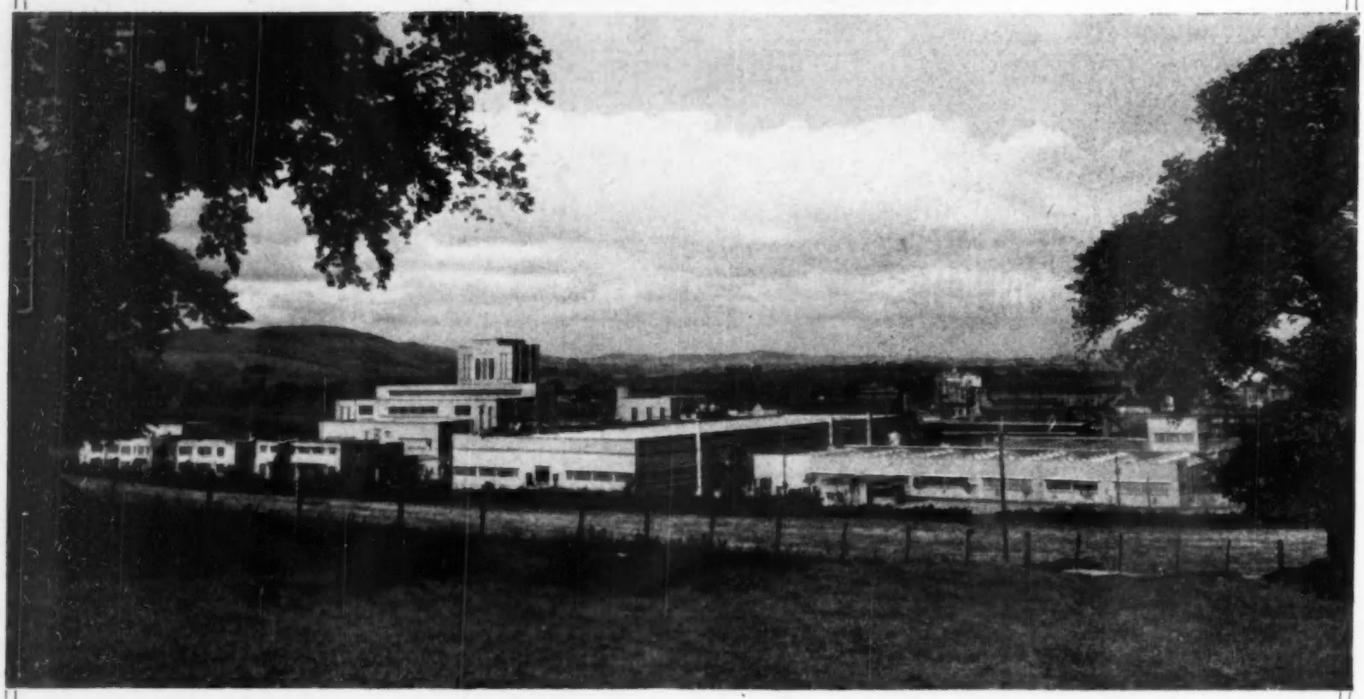
91 FARRINGDON ROAD, LONDON, E.C.1 HOLborn 7654

London Showrooms: 20/22 MOUNT STREET, PARK LANE, W.1 MAYfair 5671/2

AP 120

Enter No. 511 on reply card

More 'Melinex' in 1961



I.C.I. build new plant to produce 2,000 tons of 'Melinex' film per year

IN JANUARY 1961, a new 'Melinex' polyester film plant will start production at Dumfries with a rated capacity of 2,000 tons/year. I.C.I., who are the sole manufacturers of polyester film in this country, have been selling 'Melinex' for some years. The demand has increased rapidly and I.C.I. have been allowing imports of American and Continental film to supplement their limited production. The new plant will remove the necessity for such imports.

More and more firms are appreciating the outstanding properties of 'Melinex' film. Its unusual clarity and strength (both mechanical and electrical) combined with its great dimensional stability and resistance to heat and chemical action, are improving a very wide range of products throughout industry.

Where 'Melinex' film is now being used:

The Electrical Industry—in coils, capacitors, cables, recording tapes and loudspeakers.

Drawing Offices—as a flexible, durable and dimensionally stable drafting film.

Display—in metallised form for tinsel and as coloured tapes and panelling.

The Book Trade—for protecting covers and as a base for hot stamping foils.

Footwear & Leather goods—in metallised form for shoes and fashion accessories.

The Food Industry—for improving the sales appeal of goods and for 'boilable' packs.

The range of uses for this versatile film will widen considerably in 1961. If you would like further information or wish to discuss a possible application for 'Melinex' film, please write to I.C.I. Their Technical Service staff will be pleased to give advice and technical assistance.

'Melinex'

'Melinex' is the registered trade mark for the polyethylene terephthalate film manufactured by I.C.I.

ICI

IMPERIAL CHEMICAL INDUSTRIES LIMITED · LONDON · S.W.1

PHE 1

Enter No. 521 on reply card

LAZY LABOURERS USE NECO MOTORS

Shewn above
Battery Vehicle Motor

To trundle their trucks, because they let them linger longer at leisure. Less maintenance to do. Its just the same for you.

NECO TRADE MARK

NORMAND ELECTRICAL CO. LTD
NORTH STREET · LONDON · S.W.4

MACaulay 3211-4. Neconditi, Clapcom, London.

Enter No. 531 on reply card

THESE ARE ONLY THREE OF

2,500 DIFFERENT TOOLS

NOT ONLY 2,500 DIFFERENT TOOLS, BUT 2,500 STOCK TOOLS. AVAILABLE IN ENGLISH, AMERICAN, UNIFIED & METRIC SIZES. MADE FROM CHROME ALLOY STEEL. SUPERBLY FINISHED.

EACH ONE THE BEST IN ITS CLASS.

TOOL UP WITH CHROME ALLOY STEEL BRITOOL SERVICE TOOLS

Manufactured at
BRITOOL WORKS, BUSHBURY, WOLVERHAMPTON, ENGLAND.

Enter No. 532 on reply card

Consult FILTON For Rotary Unions—

Patented

Unions fitted with carbon bearings are available for temperatures over 400°

For use on all types of Rotary and Semi-Rotary machines for Leakproof Fluid Transfer
Standard Sizes ¼"—3" B.S.P.
Special Sizes & Designs up to 6" B.S.P.

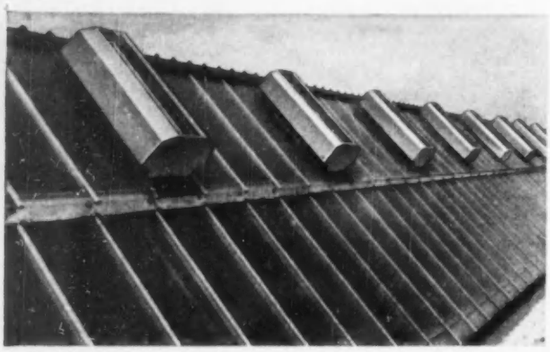
As used by leading Engineering Companies and Government Departments

FILTON LIMITED,

CLAPHAM STREET, LEAMINGTON SPA, WARWICKSHIRE
Telephone: LEAMINGTON SPA 8111/2

Enter No. 533 on reply card

balanced approach to ventilation



Stack roof ventilators.

In planning ventilation, many factors demand study. Outlet area, airflow, velocity, overall volume, air temperature, seasonal fluctuations. All these must be brought into balanced relationship before the type, location and number of ventilators is finalised. Hills are continuously assessing such factors, opening the way to better working conditions—*better production*—in foundries, rolling mills, factories. Let Hills Technical Department answer *your* ventilation problems.

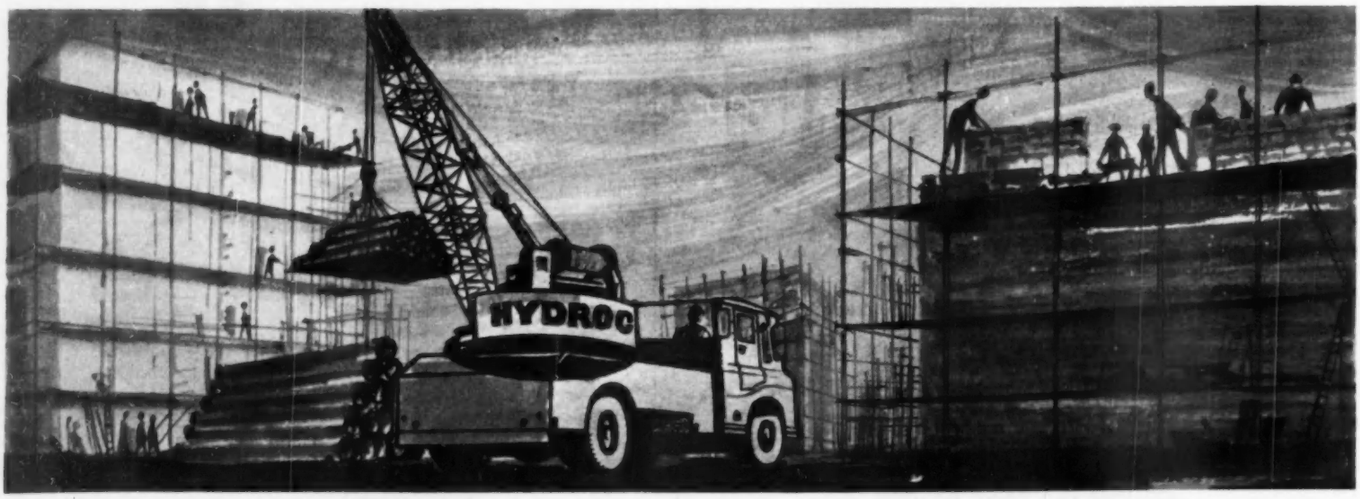
HILLS (WEST BROMWICH) **LIMITED**

ALBION ROAD, WEST BROMWICH, STAFFS.
Telephone: West Bromwich 1811 (15 lines)
London: Chapone Place, Dean St., W.1. Telephone: Gerrard 0526/9
Branches at: Manchester, Bristol, Newcastle-on-Tyne, Glasgow

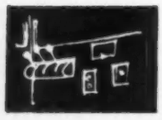
V9

Enter No. 541 on reply card

the lightweight* answer to heavyweight problems . . .



The 'HYDROCON HIGHLANDER' is winning friends all over the world. Managements are enthusiastic over its many advanced technical features which bring lower costs — higher profits. Operators acclaim the Hydrocon Highlander because it is utterly simple to use. Whenever materials have to be moved—this is the machine to move them—speedily, safely, *cheaply*.



One cab, one operator, full circle slewing. No clutches, no electric motors. Finger-tip controls, permitting 3 motions at once. Jibs up to 56', erected without mechanical assistance. Rapidly lowered outriggers with universal foot pads. Rotary Hydraulic Motors for precision control—full interchangeability—no maintenance. Fast winch speeds—'double safety' brakes—power lowering for precision control. One rope for all jib lengths. Winch parts 90% interchangeable. 5 ton capacity—fully slewing model.

★ROBUSTLY CONSTRUCTED THROUGHOUT

The Hydrocon Highlander is fully described in colour brochure. Please write or your copy.

LAMBERT ENGINEERING COMPANY (GLASGOW) LIMITED
Burnfield Works · Burnfield Road · Giffnock · Renfrewshire · Scotland

Sole distributors in England and Wales: BROWN & TAWSE (PLANT) LTD., Ambrose Street, West Gorton, Manchester, 12. *Grams:* Haxameter Manchester 12. *Tel:* Manchester East 2231 (5 lines). Also at Birmingham and London.
Scottish agents: J. A. STEWART (PLANT) LTD., Milnbank Works, Townmill Road, Glasgow, E.1. *Grams:* Jasplant, Glasgow. *Tel:* Bridgeton 4441

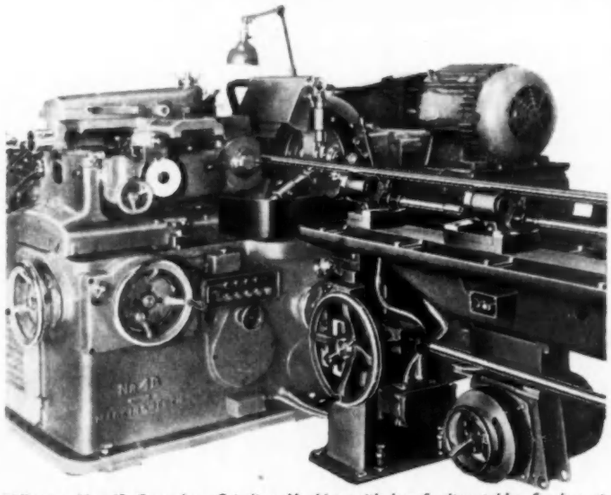
HYDROCON HIGHLANDER
FULLY SLEWING MOBILE CRANE

Enter No. 542 on reply card

LIDKOPING

Lidkoping No. 5B Centreless Grinding Machine with bar feeding tables for bar up to 8 in. dia. × 20 ft. long.

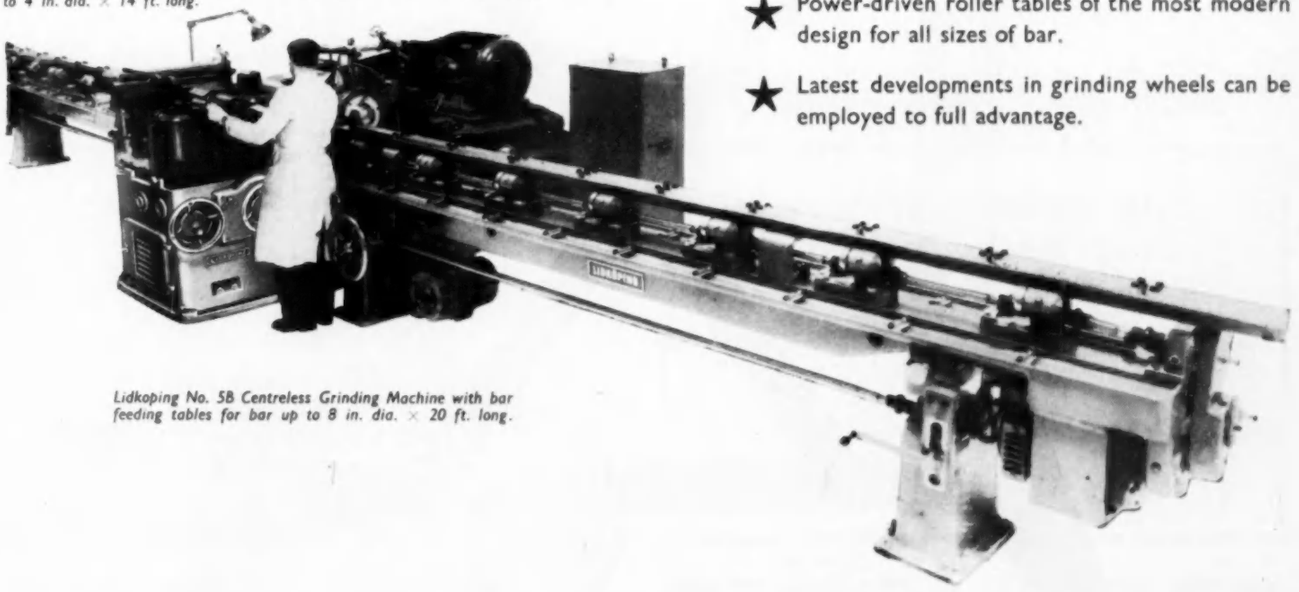
for maximum production on Bar Grinding



Lidkoping No. 4B Centreless Grinding Machine with bar feeding tables for bar up to 4 in. dia. × 14 ft. long.

Lidkoping Centreless Grinding Machines are of exceptionally robust design and incorporate many features which have established their reputation for reliable, accurate, long-run production. Some of their advantages are listed below.

- ★ Greater operating through-feed speed, even for bars above 2 in. dia.
- ★ Largest quantity of stock removal at each pass.
- ★ Highest accuracy of diameter and roundness, even on large diameter work.
- ★ Quick change-over from one diameter bar to another.
- ★ Black-rolled material ground as easily as drawn or turned stock.
- ★ Power-driven roller tables of the most modern design for all sizes of bar.
- ★ Latest developments in grinding wheels can be employed to full advantage.



Lidkoping No. 5B Centreless Grinding Machine with bar feeding tables for bar up to 8 in. dia. × 20 ft. long.

Sales and Service for the British Isles

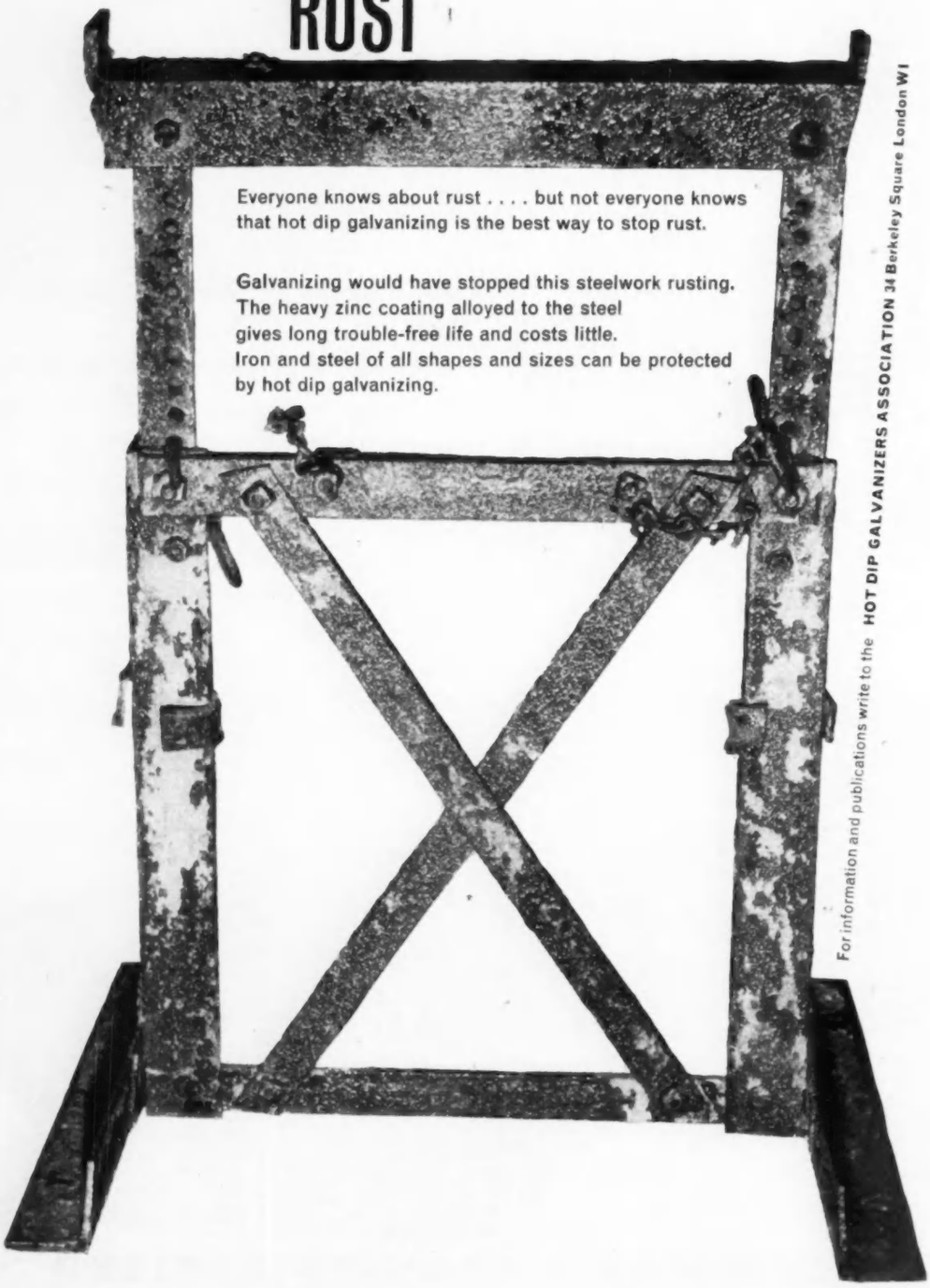
DRUMMOND-ASQUITH LIMITED

Member of the Asquith Machine Tool Corporation

KING EDWARD HOUSE, NEW ST., BIRMINGHAM *Phone: Midland 3431. Also at LONDON Phone: Trafalgar 7224 & GLASGOW Phone: Central 0922*

Enter No. 551 on reply card

STEEL NEED NOT RUST



Everyone knows about rust . . . . but not everyone knows that hot dip galvanizing is the best way to stop rust.

Galvanizing would have stopped this steelwork rusting. The heavy zinc coating alloyed to the steel gives long trouble-free life and costs little. Iron and steel of all shapes and sizes can be protected by hot dip galvanizing.

For information and publications write to the HOT DIP GALVANIZERS ASSOCIATION 34 Berkeley Square London W1

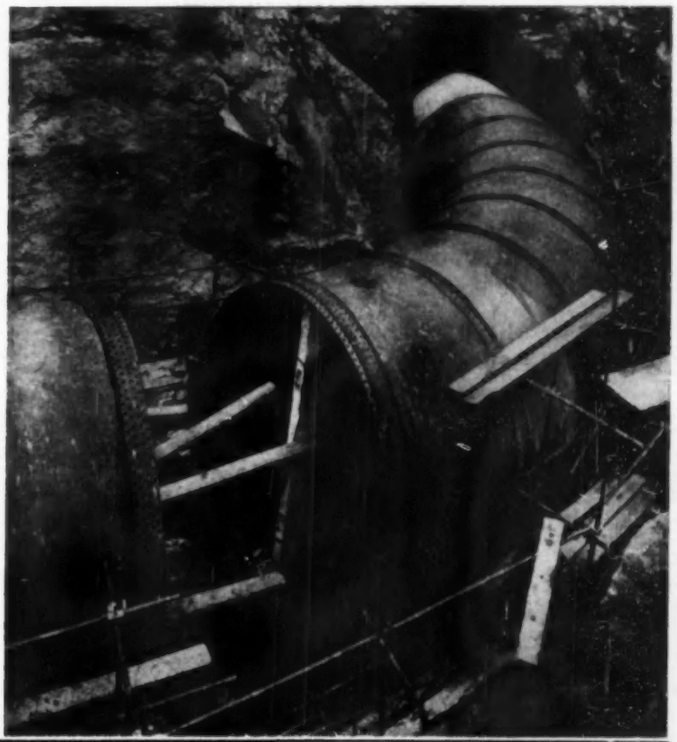
Enter No. 561 on reply card

Structural Steel Work

of all descriptions

STEEL BRIDGES
STEEL PIPELINES
STEEL STRUCTURES
STEEL RAILWAY WAGONS

Shipbreakers and Dismantlers
Iron and Steel Stockholders
Non-ferrous Metal Merchants
Machine Tool Specialists



P. & W. MACLELLAN, LTD. *Established 1811*

Offices and Warehouses: 129 TRONGATE, GLASGOW, C.1 *Telephone: Bell 3404 (20 LINES)* *Works:* CLUTHA WORKS, GLASGOW, S.1 *Telephone: IBROX 1135*
LONDON: CLUTHA HOUSE, 10 STOREY'S GATE, WESTMINSTER, S.W.1

Enter No. 571 on reply card

6" GUNMETAL STOP VALVE
for gaseous nitrogen

WORKING PRESSURE—3,400 P.S.I.
WEIGHT—1 TON, 1 CWT., 2 QRS.

Stainless steel trim. Overall length 40"

Special and standard valves in gunmetal, monel metal and stainless steel for all temperatures and services

ALSO
Castings in gunmetal up to 5 tons

by SHIPHAMS

SHIPHAM & COMPANY LTD · HAWTHORN AVENUE, HULL · Tel: 37654
A MEMBER OF THE NEWMAN HENDER GROUP

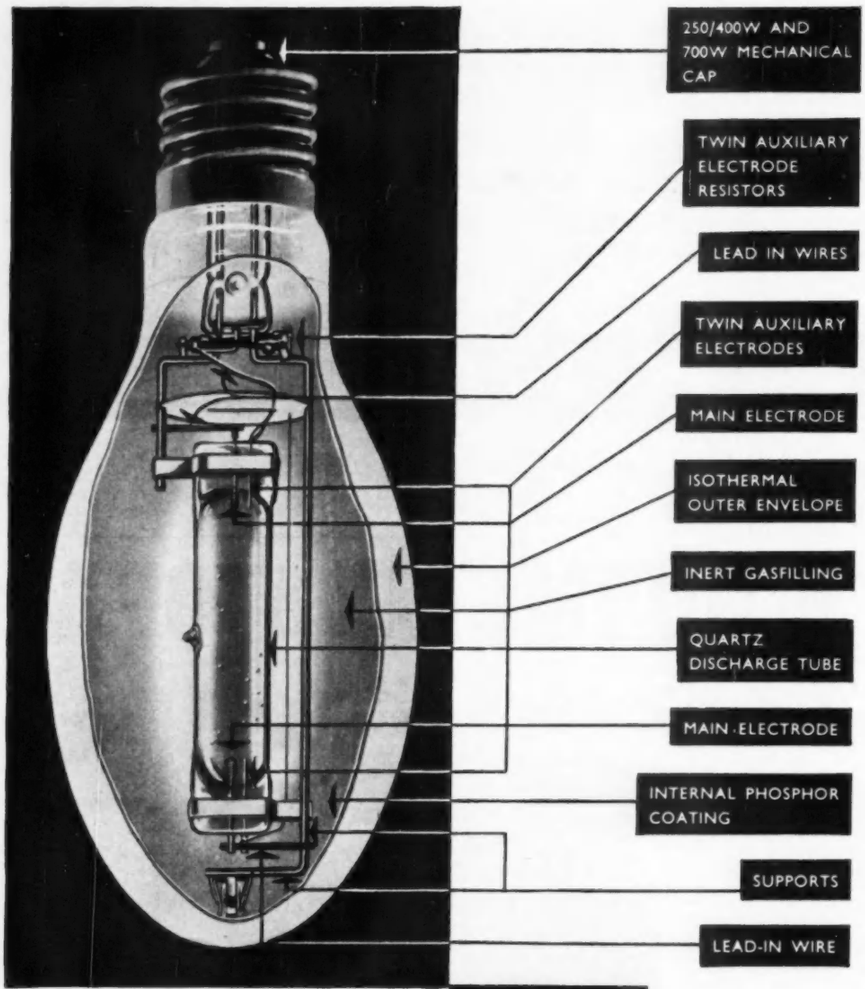
BCA

Enter No. 572 on reply card

Focus on
PHILIPS

MBF

MERCURY DISCHARGE LAMPS
Long life, high efficiency and improved colour rendition



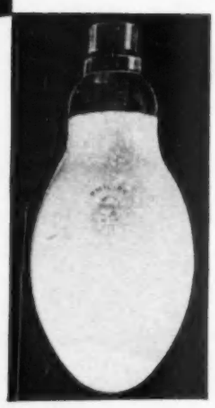
The unique Isothermal shaped envelope of this range of lamps—seven ratings, 50 to 1000 watts—ensures long life of all components. By means of optimum heat distribution, it prevents deterioration of the excellent colour rendering property of the phosphor.

The high pressure quartz discharge tube is mounted by an exclusive system that defeats vibration and wastage of light, and reduces the number of working parts.

This mechanically made discharge tube is sealed in nitrogen and is filled with argon and mercury. Special features of its construction are twin auxiliary electrodes on ratings above 250 watts to ensure reliable ignition, even at temperatures as low as -40° C.

An exclusive feature is a new capping process, which screws the glass into the cap without cement.

* No voltage grades—all lamps suitable for 200/250 volts. Stock problems eliminated!
* Universal burning position.
* Largest range—50 to 1000 watts through seven ratings.
* Unique Isothermal shape ensures long life and colour maintenance.
* 250-400 & 700 watt have mechanical caps. No cement means no loose caps—ever!
* Mechanical manufacture of all components ensures extreme reliability and quality constancy.



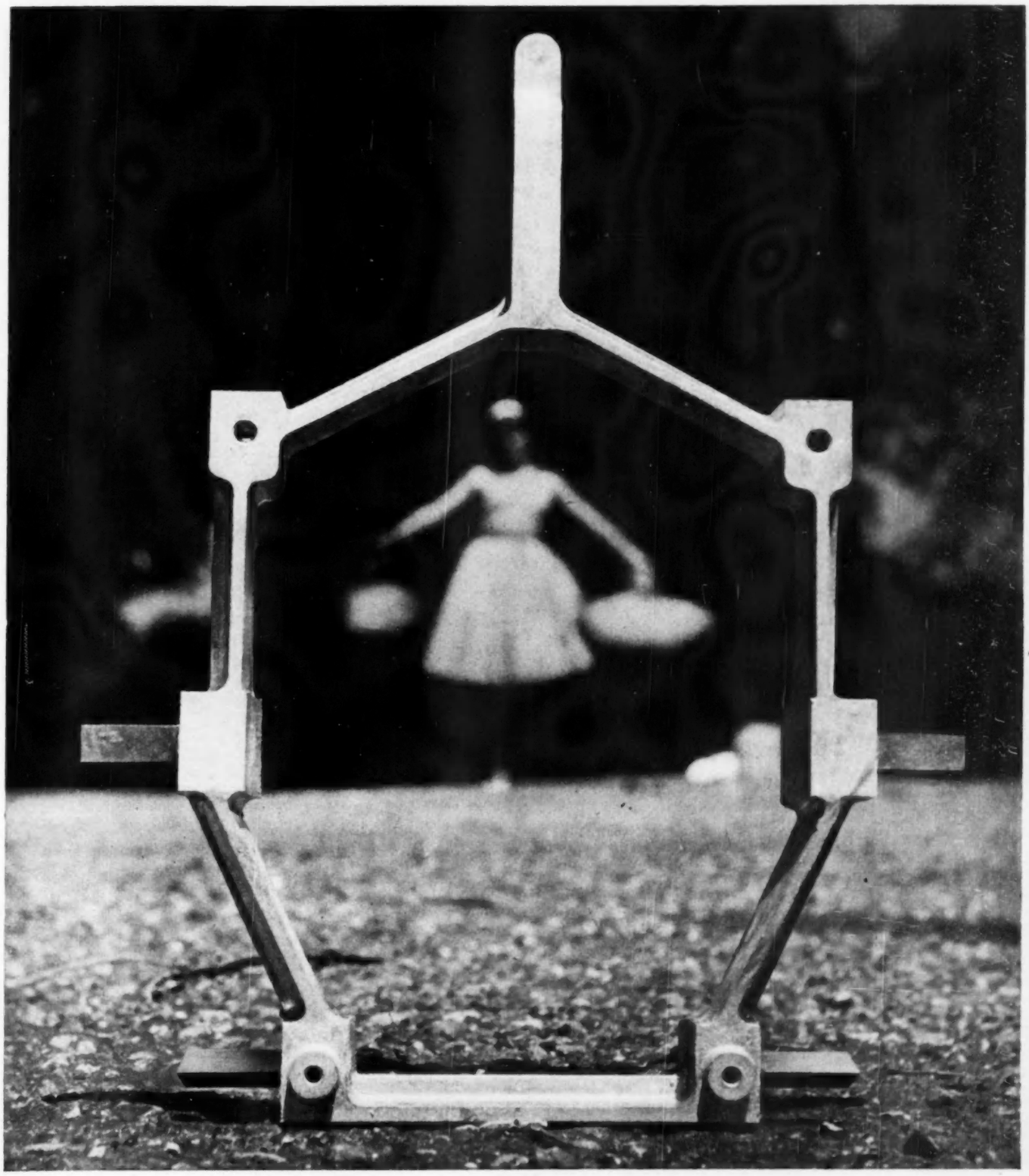
PHILIPS

PHILIPS
LEAD THE WORLD IN LIGHTING

PHILIPS ELECTRICAL LTD · CENTURY HOUSE · SHAFTESBURY AVE · LONDON WC2

(LD3309A)

Enter No. 581 on reply card



This piece of garden sculpture is a good deal smaller than it looks—in fact about 8 inches high. It is the balance beam of a well-known type of indicating counter scales; a pressure die casting with the hardened steel knife edges cast as inserts, and positioned with complete dimensional accuracy and dead parallel. **Sparklets die castings by . . .**

THE BRITISH OXYGEN COMPANY LTD · SPARKLETS WORKS · LONDON N.17 · TEL: TOTTENHAM 0881

Enter No. 591 on reply card

Sparking time: 1 hour 55 mins

THIS MEDAL DIE took 1 hour 55 minutes to make on the new GKN Spark Machine, Model B2. How long would it have taken by other methods?

When you've worked it out, consider the GKN Spark Machine. *It is faster, more accurate, more versatile, more compact and better designed than any other machine of its kind,* yet both installation and running costs are low.

The GKN Spark Machine was designed by the GKN Group Research Laboratory. Not only is it backed by all the Laboratory's technical resources, but *every user of the GKN Spark Machine can count on regular visits from the makers' Technical Representative to ensure that he gets the most from his machine.*

Whether you are engaged in forging, wire-drawing or press-tool making, the GKN Spark Machine is something it will pay you to know about. Ask our sales agents for an illustrated brochure on the GKN Spark Machine (Models B1 & B2). Ask them now.

The GKN Spark Machine

DESIGNED BY THE GKN GROUP RESEARCH LABORATORY

WELSH METAL INDUSTRIES LTD.,
Caerphilly, Glamorganshire.

Sales Agents U.K.

M. C. Layton Limited, Abbey Wharf,
Mount Pleasant, Alperton, Wembley, Middx.

Rudkin & Riley Limited,
Cyprus Road, Aylestone, Leicester.

Enter No. 601 on reply card

"No need to resign, Bungleigh!"

"But just look at the mess I'm in! A Knight down, Queen threatened, and my Sicilian Defence in ruins! Can't concentrate, that's my trouble. Not with this cooling water problem on my mind...."

"What's that you say? General Descaling? A **complete** service for the cleaning of every type of pipeline and industrial plant? And I can buy equipment and materials from 'em if I want my own men to do the job? Sounds like the end of my problems—I'll ring first thing to-morrow!"

"And talking about problems, what about B-Q6? There! He thought I'd missed that. Looks as though I'm on to another winner!"

For full information and literature on any aspect of pipeline or sewer maintenance, please write to General Descaling, stating the service or type of equipment in which you are interested.

General Descaling

the experts in pipeline and sewer maintenance

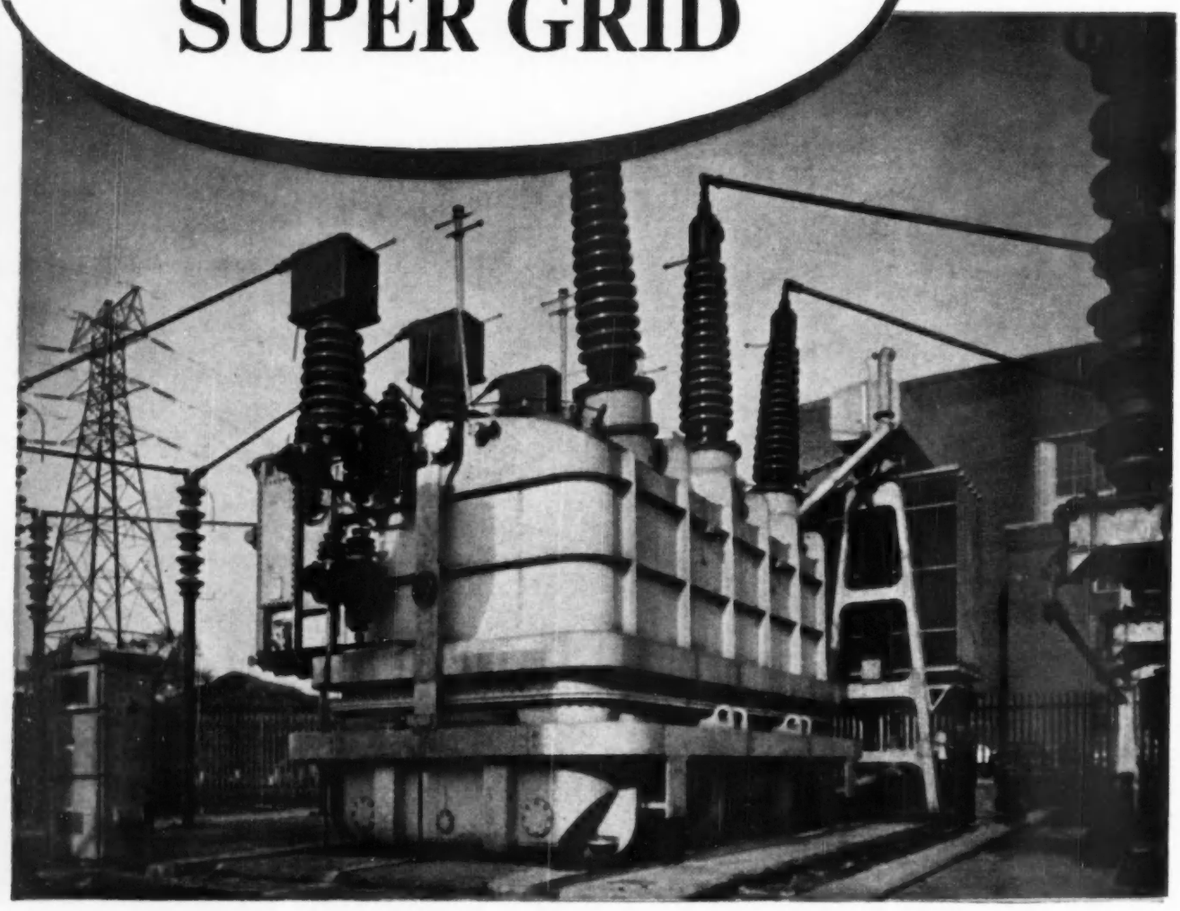
GENERAL DESCALING COMPANY LIMITED WORKSOP NOTTS.

TELEPHONE: 3211/5 TELEX: 54159

OA/6052A

Enter No. 611 on reply card

GRID linked to SUPER GRID



The first 180 MVA, 3 phase, 132/275 kV auto-transformer to be completed for the Central Electricity Generating Board.

Illustration shows the first of two of these transformers at the Skelton Grange Substation of the Yorkshire Division of the C.E.G.B.

The transformers, each fitted with resistor transition on-load tap changers, were manufactured at the AEI Rugby Transformer Works.

For further details write to AEI Transformer Division, Southmoor Road, Wythenshawe, Manchester 23 or your local AEI office.

AEI **Associated Electrical Industries Ltd.**
Transformer Division
MANCHESTER AND RUGBY

E/A002

Enter No. 621 on reply card

single lever control

for

infinitely variable speed

instant reversal

dynamic braking

This hydrostatic drive is now used in

TRACTORS
LOCOMOTIVES
CRANES
SHOVELS
ROLLERS

and other off-the-road vehicles.

DOWTY Dowmatic DRIVE

Now in full production for the 35-80 H.P. range

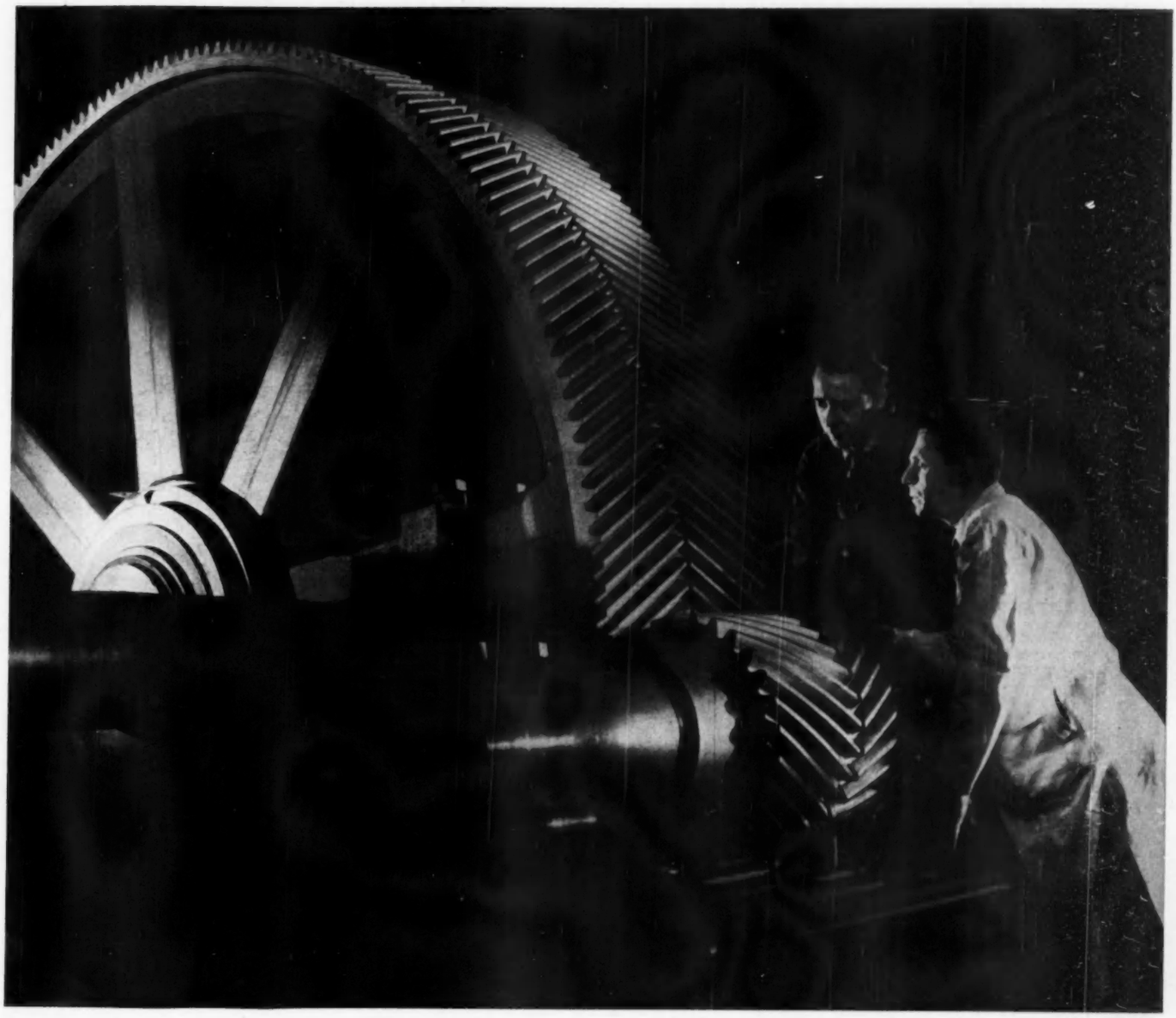
DOWTY HYDRAULIC UNITS LTD · ASHCHURCH · GLOS

Member of the Dowty Group *Telephone: Tewkesbury 2271*

Enter No. 631 on reply card

ALL TYPES OF
MECHANICAL HANDLING PLANT
...of any capacity. Designed, constructed and set to work in all parts of the world.
STRACHAN & HENSHAW LTD
Steelhoist Works • Bristol • England
Telephone: 78331

Enter No. 641 on reply card



Top Gears for Industry

The top gear today, of course is made by David Brown — just as it has been for one hundred years. And there's a good reason for this universal approval of a famous name — for David Brown make the biggest range of gears in the country. Everyone is fully proved and unsurpassed in its class for accuracy, quiet running and dogged dependability.

It adds up to this — more and more manufacturers are going straight into top with David Brown gears.

DAVID BROWN

An alliance of engineering specialists in gearing, machine tools, casting, automobiles, and agricultural tractors and machinery.

100 YEARS 1860-1960

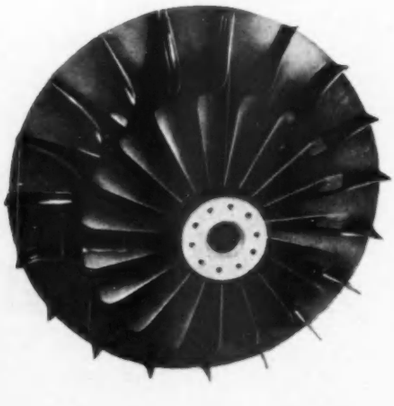
THE DAVID BROWN CORPORATION (SALES) LIMITED

GENERAL GEAR DIVISION, PARK WORKS, HUDDERSFIELD. TELEPHONE: HUDDERSFIELD 3500 OA/6015

Enter No. 651 on reply card

'Familiar' Protection . . .

. . . in more senses than one — the fearsome decorative coating on the aboriginal's face serves to keep away harmful 'familiars' or spirits; a surface coating of Araldite not only resists spirits, but successfully prevents the ravages of acids, alkalis and solvents. Widely used in the foodstuffs and pharmaceutical industries for the internal coating of cans and collapsible containers, Araldite is unaffected by the action of most chemicals, heat and humidity. Araldite forms a tough flexible film that does not break down even when the surface to which it is applied is drawn or extruded. The tenacious qualities of Araldite are utilised to the full in the surface protection of impellers of jet engines.



ARALDITE epoxy resins

Araldite is a registered trade name

CIBA (A.R.L.) LIMITED · DUXFORD · CAMBRIDGE

TELEPHONE: SAWSTON 2121

AP563

Enter No. 661 on reply card

Fabricated Pulley Wheel

one of a pair forming part of a complete Headgear for the N.C.B. at Silverhill Colliery, Teversal, Notts.

made . . . assembled . . . erected by

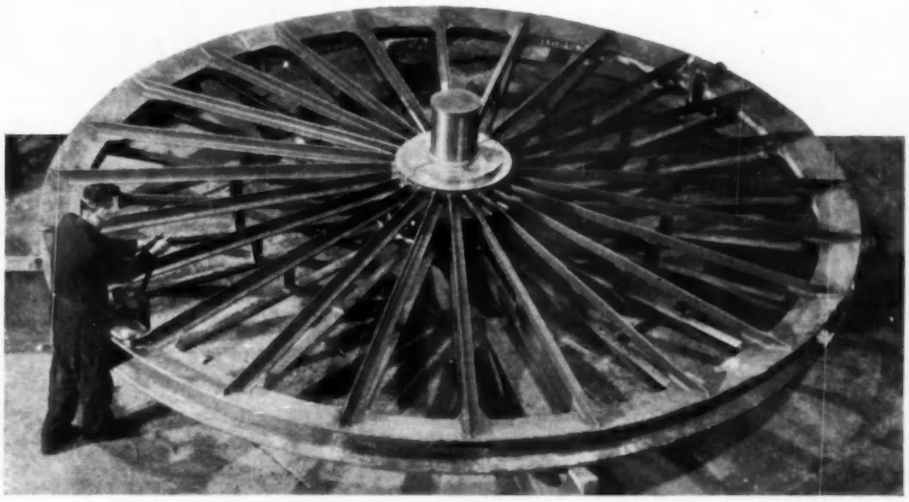
SHEEPBRIDGE

The recent installation of a complete headgear at Silverhill Colliery, Teversal, Notts., marked the final stage of yet another engineering achievement by SHEEPBRIDGE.

The headgear is seventy feet in height, and each of the two pulley wheels weighs five and a half tons, and measures sixteen feet in diameter.

They were made and assembled in the Sheepbridge shops, and the complete headgear was then erected in fourteen days. This is the measure of Sheepbridge success. For a successful solution to your mining equipment problems . . .

. . . Consult SHEEPBRIDGE



SHEEPBRIDGE EQUIPMENT LTD.

(One of the Sheepbridge Engineering Group)

Sheepbridge Works, Chesterfield, England · Telephone : Chesterfield 5471 · Telegrams : Sheepbridge, Chesterfield

Enter No. 671 on reply card

CONTROL SYSTEMS

We design and make complete
CONTROL SYSTEMS:
Electrical, Electronic or Photo Electric for
OPERATION
By Electric, Pneumatic, Hydraulic or Mechanical means
APPLICATIONS:

We can control the operation of almost every machine for almost every purpose. We can control levels, numbers, timing, registration, dimensions, weight, rate of flow, rate of change, grading of sizes.

Write to:

HIRD-BROWN LTD.
244 MARSLAND ROAD, SALE, CHESHIRE
or ring Pyramid 1959

Enter No. 672 on reply card

LIGHT IN WEIGHT, TOUGH, AND DURABLE WITH GOOD ELECTRICAL PROPERTIES

CAN BE MOULDED, PUNCHED AND MACHINED

SUITABLE FOR COUNTLESS ELECTRICAL AND MECHANICAL APPLICATIONS

PLEASE HELP STAMP OUT PLASTICS

That's PAXOLIN

M & I make PAXOLIN synthetic resin bonded materials in a wide range of grades with paper, fabric, asbestos, glass and other fillers. It is supplied in the form of sheets, tubes and cylinders as well as punched, moulded and machined parts. If you would like to know more about Paxolin, write or 'phone for descriptive literature.

Examples of Paxolin punchings, mouldings and machined parts.

the electrical insulation people

m and i

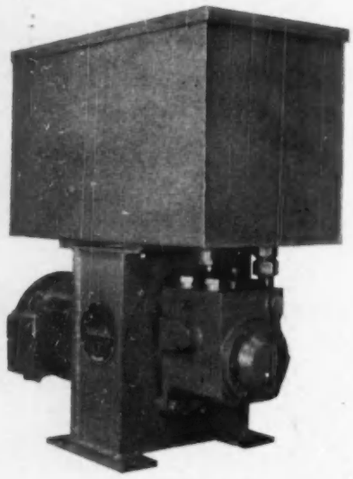
THE MICANITE & INSULATORS CO., LTD.,
Blackhorse Lane, Walthamstow, E.17. Tel: Larkswood 5500.
Grams: Mytilite, London, Telex. Telex: 25183.

"PAXOLIN" is a registered trade name of The Micanite & Insulators Co., Ltd.

Enter No. 673 on reply card

SUTCLIFFE HYDRAULIC PUMPS

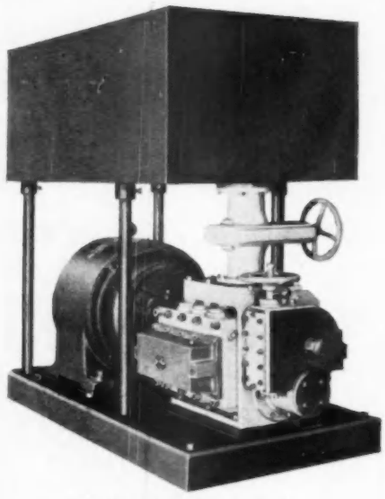
. . . fixed capacity or infinitely variable flow from zero to maximum capacity



FIXED FLOW PUMP

Control of variable flow may be either Manual, Mechanical or Automatic. The pumps may be supplied as separate units or in power pack form.

We shall be pleased to discuss the design and manufacture of pumps to meet your specific requirements.



VARIABLE FLOW PUMP

Sutcliffe

SUTCLIFFE HYDRAULICS LIMITED

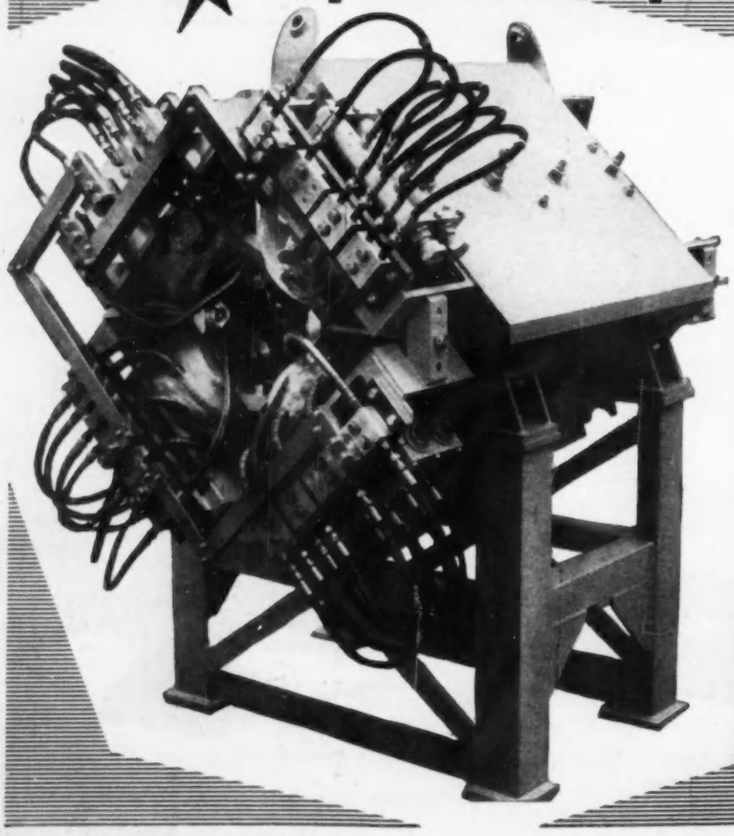
SPEEDWELL WORKS · WHITWOOD · CASTLEFORD

TELEPHONE: CASTLEFORD 3211

A SUTCLIFFE ENGINEERING INDUSTRIES COMPANY

Enter No. 681 on reply card

★ quadrupole magnet



to Harwell designs and drawings

Comprising 4 sets of water-cooled windings, each winding being 3 double layers of conductor, size $\frac{3}{16}$" square, with a .22" bore; windings vacuum-impregnated with Araldite. Yokes, Pole Pieces and Pole Tips fully-machined to produce an accurate parallel dimension of 8" ± .008" through the Pole Tips.

a perfect example of

LINTOTT

specialised fabrication

Fabrication up to 20 tons in general purpose plant, plus tool room and electrical work on special purpose production equipment—that's how Lintott's cover the whole engineering field. Collaboration with designers and plant engineers includes pattern making and prototype work to a high standard. Current production includes equipment for the electronic, atomic energy and petro-chemical industries. You may need Lintott's specialised services—why not make the contact now?

AYLING INDUSTRIES GROUP

H. & E. LINTOTT LIMITED

Horsham, Sussex. Telephone: Horsham 3316

Enter No. 682 on reply card

MINING THE SKY

Out of the air we breathe—a new raw material for Consett steel

A REVOLUTION is taking place in steelmaking and Consett is in the forefront of it.

Oxygen is the basis of this revolution. Conventional methods of refining iron into steel use air; the breakthrough lies in the use of oxygen instead —pure oxygen, extracted by the ton from the air we breathe. Consett will be the first steelworks in the world to use *two* of the new oxygen processes—the L.D. process from Austria, and the Kaldo process from Sweden.

In both these processes 100 tons of impure molten iron from the blast furnaces will be poured into barrel-shaped vessels weighing over 400 tons apiece with their linings. Then high pressure jets of oxygen are blown on to the surface of the molten metal, refining it to steel. The L.D. and Kaldo processes both give a spectacular increase in productivity and an equally spectacular *decrease* in fuel consumption. And an additional advantage over the older, air-blown Bessemer converters is that they can absorb higher proportions of cold scrap or even iron ore, which considerably reduces raw material costs.

The new plant should be working by the end of 1961, producing for Consett an additional ¾ million tons of steel a year. In increasingly competitive world markets Consett does not mean to be left behind.

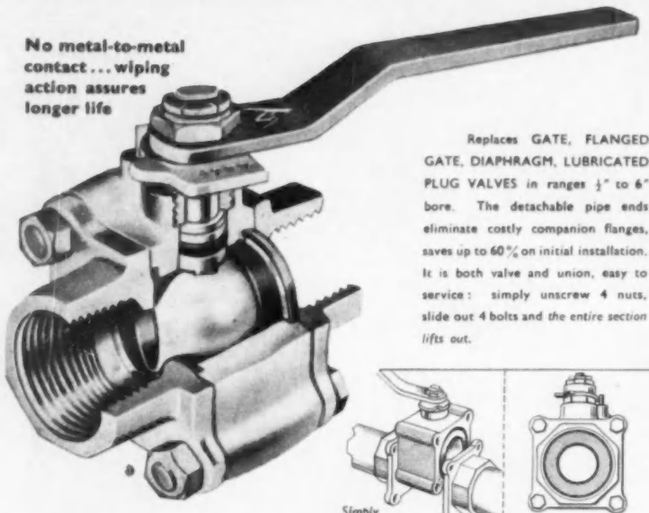
CONSETT
IRON COMPANY LIMITED

CONSETT, COUNTY DURHAM · TEL: CONSETT 341 (12 LINES)
TELEGRAMS: "STEEL PHONE CONSETT"

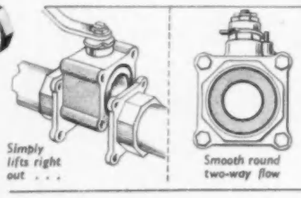
Enter No. 691 on reply card

Compare the 'WORCESTER' BALL VALVE with any other ON-OFF valve!

No metal-to-metal contact... wiping action assures longer life



Replaces GATE, FLANGED GATE, DIAPHRAGM, LUBRICATED PLUG VALVES in ranges ¼" to 6" bore. The detachable pipe ends eliminate costly companion flanges, saves up to 60% on initial installation. It is both valve and union, easy to service: simply unscrew 4 nuts, slide out 4 bolts and *the entire section lifts out.*



Simply lifts right out . . . *Smooth round two-way flow*

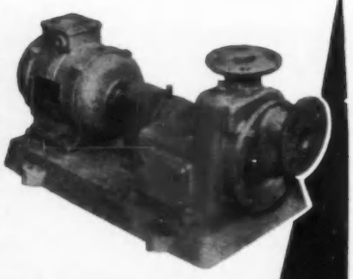
Send for all particulars to:-

THE WORCESTER VALVE CO., LTD.

62 CHURCH ROAD · BURGESS HILL · SUSSEX · Telephone 85678

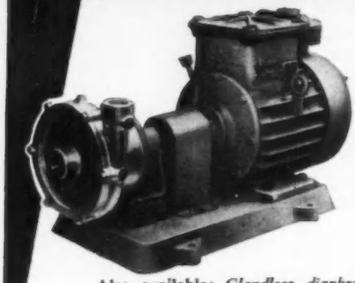
Enter No. 701 on reply card

1" AUTOSTART self priming pump with open type impeller for passing small solids in suspension, no internal valves or fine clearances. Capable of suction lifts of 20 feet and heads up to 60 feet. Fitted exclusively with mechanical shaft seals.



STAINLESS STEEL PUMPS

FOR CORROSIVE LIQUIDS ACIDS CHEMICAL SOLUTIONS



1" centrifugal pump fitted with mechanical seal and coupled to flame proof motor. Other types available where gland packing is specified. Pump sizes; up to 1½" screwed BSPT, and 2" flanged BSS'D'

Also available: *Glandless diaphragm pumps constructed of cast iron, bronze or ebonite lined cast iron for pumping corrosive and abrasive liquids.*

GIRDLESTONE PUMPS LTD

23 Davies Street, London, W.1. *Phone: Mayfair 1354*

TIB 139

Enter No. 702 on reply card

HYDRAULIC PRESSINGS AND ROLLED RINGS

by

Caston Barber

HYDRAULIC PRESSINGS

Producing Hemispherical ends and other hydraulic pressings of up to 3 feet in diameter, Caston Barber have a wide range of existing tools, a list of which will gladly be sent on request. Dished and Flanged cylinder ends, with or without inspection openings, are also manufactured to order.

ROLLED RINGS

Caston Barber produce rings from a wide range of flat and angled sections of mild or stainless steel. Flanged rings and washers are supplied to meet all specifications and in many cases the rings are flash butt welded.

Caston Barber have the equipment and the experience to meet your requirements.

Do not hesitate to write or telephone your enquiries to:

CASTON BARBER, 47 TABARD STREET, LONDON, S.E.1 Telephone: HOP 1991/5

Enter No. 703 on reply card

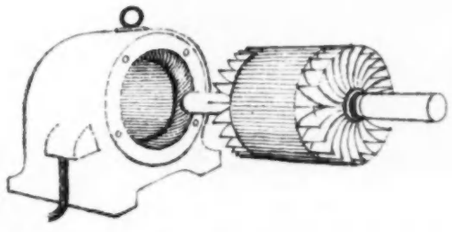
Electrical Aids in Industry *Data Sheet* **No. 14**

Electric Motors & Controls-1

Most manufacturers today employ electric motive power through individual drives, which, among their many advantages, permit the right type of motor to be used for each of various types of machine. The range of motors available—each with its own characteristics—is very large, and the factory executive could well be guided in his choice by the expert views of the motor manufacturer, the installing engineer or his Electricity Board's engineer. The characteristics of the main types of motor are briefly summarised below.

Squirrel-cage Motors

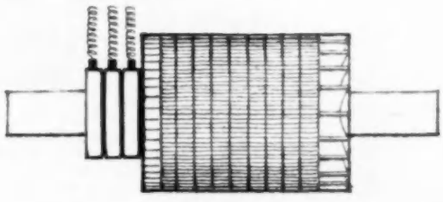
These are the most straightforward and simple in design, and are therefore relatively cheap and robust in character. They should be considered for general duties and for applications requiring variable speeds in conjunction with variable-speed gears or couplings, e.g., for crane drives. Small sizes can be switched direct-on-line.



The squirrel-cage motor is very suitable for individual drive of each motion of single-purpose machine tools where the motor horsepower can be precisely specified. It is suitable for driving pumps, fans, lifting hoists and woodworking machines. Textile machinery represents another field of use.

Slip-ring Motors

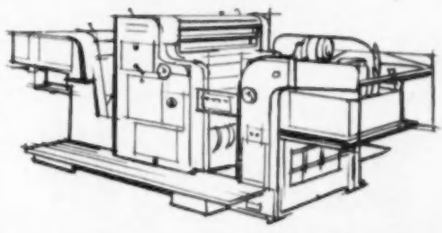
The chief advantage of the slip-ring motor is a very low starting current for a given torque, e.g., full-load torque at starting with a current about 10% above full-load current. This makes it suitable for applications requiring a prolonged starting period with a load of



high inertia. It also permits of speed variation below synchronous speed, though with some loss of efficiency. Typical applications include fans, pumps, heavy lathes, grinders and boring mills, as well as calendering machines, cable-laying-up machines and mine hoists.

Three-phase A.C. Commutator Motors

The main characteristic of this type is variable-speed with uniform and gradual acceleration and good efficiency over the speed range. Paper manufacture provides excellent examples of its use, e.g., in paper-making, reeling, cutting, calendering, coating and drying.



A.C. commutator motors are recommended for mechanised bakeries and for cranes and hoists where very slow speeds are frequently needed.

Synchronous Motors

These are constant-speed motors. One particular advantage is that they can be operated at unity or even at leading power factor to correct a system suffering from lagging power factor, and perhaps so qualify for a reduction in the electricity bill. Pump and compressor drives are typical uses to which they can be put. They are also used in motor-generator sets.

Single-phase A.C. Motors

In general, single-phase motors are used in light industries for drives not requiring more than about five horsepower or where a three-phase supply is not available. While their use is mainly limited to work of a light nature, they do fill a need in such duties as sewing-machine drives, portable hand tools, window opening and closing gear, etc.

Direct Current Motors

For a completely unfettered performance where wide ranges of speed variation, high rates of acceleration and powerful dynamic braking are all-important, the D.C. motor is unrivalled. This means in effect the installation of an A.C.-D.C. motor-generator set or rectifier to give the necessary supply, but the increased cost may well be compensated by the improvement in productivity. When variable voltage is applied to the armature, a wider speed range is obtainable than with any other type of motor. Typical applications of the D.C. motor are: cranes, haulage and tippler equipment, certain machine tools requiring a large speed range and smooth acceleration, high-speed printing and steelworks drives.

For further information, contact your Electricity Board or write direct to the Electrical Development Association, 2 Savoy Hill, London, W.C.2. TEMple Bar 9434.

They can offer you excellent reference books on electricity and productivity (8/6, or 9/- post free)—"Electric Motors and Controls" is an example.

E.D.A. also have available on free loan within the United Kingdom a series of films on the industrial uses of electricity. Ask for a catalogue.

7914-1

CUT HERE

A 4000lb Coventry Climax diesel fork truck loads a lorry at Colgate-Palmolive Manchester factory for despatch to depot

Two small illustrations show Coventry Climax UNIVERSAL 2000lb and 4000lb Electric Fork Trucks marshalling loads on special pallets which speed up loading

Superquick to Supermarket . . .

Colgate-Palmolive
hurry 'AJAX' and 'OLA'
on it's way with—

Coventry Climax
fork lift trucks

COVENTRY CLIMAX ENGINES LTD., (DEPT. ENG.) COVENTRY

Enter No. 721 on reply card

THE ENGINEER

No. 5471 DECEMBER 2, 1960 Vol. 210

THE TWO ASWAN SCHEMES

"It is doubtful if any dam in history has received as much publicity as the Aswan dam in Egypt." So remarked Messrs. G. F. Kennedy and V. Furoskog in opening the paper "The Aswan Hydro-Electric Scheme" which they presented jointly at the Institution of Civil Engineers on Tuesday, November 22. The paper describes an installation of 350MW of generating plant constructed at the Aswan dam over the past seven years, and now nearly complete, at a cost of about £30,000,000. Given the scale of the installation, and the dam already in existence, the work described follows generally along the lines which would be expected. Nevertheless its construction is hailed as a feat of international co-operation: "The work had to be executed during a period when there were many changes on the Egyptian scene. These, at times, brought contractual and other problems not usually encountered on works of this character, but universal goodwill always seemed to provide a satisfactory solution." Perhaps this is one of the understatements of the year, but at least it emphasises how the engineering profession, both in this country and Egypt, has objectively by-passed much of the political disturbances of recent years.

The same tradition was in evidence at the Institution's meeting in the previous week when two papers by Dr. A. A. Ahmed, formerly technical consultant to the Egyptian Ministry of Public Works, were discussed. The considerable fund of knowledge and experience amongst British engineers of the special problems of the Nile and its control was immediately evident at this meeting. Dr. Ahmed's papers ("Recent Developments in Nile Control," and "Storage Losses in the Nile Basin with Special Reference to Aswan") were quite different in character from the one just mentioned and were particularly controversial in his assessment of the proposed "High Dam" at Aswan. This proposal would completely control the river, and would provide "over-year" storage. Its history, as a project, is well known, all that need be mentioned here being that the British consultants were dispensed with as a condition of comprehensive Russian assistance in the Spring of the year. How much progress has since been made by the Russians was not stated by any of the speakers.

The high dam has become almost a sort of latter-day Pyramid, of great influence in politics and matters of national prestige in Egypt. The first point to make, therefore, is that it is clear that Dr. Ahmed's approach was strictly professional, as, indeed, was that of his critics, and was concerned solely with the engineering merits of the scheme. On this basis alone, however, his comments were quite startling. He asserted that losses from the high dam reservoir appeared to be so great as to make the dam of doubtful benefit, if not hazardous. Evaporation and seepage are the two principal losses. Dr. Ahmed not only criticised the method of arriving at the required reservoir capacity in the official report on the dam, but gave his own figures for these losses, which are considerably higher, for various reasons which he explained in detail. Stated as briefly as possible, the conclusion he arrived at, expressed in milliards (1 milliard $= 10^9$) of cubic metres, was this: The high dam reservoir would have a capacity of 130 milliards of cubic metres of which 30 is for a silt trap and for dead storage, 70 for over-year storage and 30 for annual working and flood protection. Taking the capacity as 100 (i.e., leaving out the "annual" storage) the losses per annum would be 124 in the first 20-year period after building the dam, 68 in the 20-30 year period and 17 thereafter. Since the average Nile discharge is 83 milliards, this means that all discharge would be lost in the first twenty years, and after thirty years 66 milliards would be available for irrigation, i.e., 12 more than at present. The official view is that the reservoir would give an annual draught of 82 milliards, of which 10 would be losses, leaving about 72, an increase of 18 over the present figure. Dr. Ahmed also criticised the design of the dam — rockfill on sand — and the fact that it would trap all the silt which was essential to irrigation, he asserted. He proposed an alternative scheme based on the use of a natural depression as a storage basin, connected with the Nile by a canal, with which about 20 milliards of storage would, he computes, give complete over-year control, i.e., a constant annual draft in excess of 70 milliards.

Virtually all of these major criticisms were challenged by speakers at the discussion, speakers with experience and knowledge of the Nile comparable with that of the author himself. It would be quite vain for us to take sides in this controversy. Our aim is limited to reporting an unorthodox point of view, and to echoing the President of the Institution, when he welcomed the presentation of the paper and the temerity of the author, pointing out that full discussion of fundamental issues such as these is the most valuable form which Institution meetings can take.

MECHANICALS GET NO RATE RELIEF

It has now finally been decided after some years of litigation that the Institution of Mechanical Engineers is not entitled to exemption from rating under Section I of the Scientific Societies Act of 1843. In March, 1958, the Institution appealed to the Lands Tribunal against the decision of the Central London Local Valuation Court that it was liable to pay rates to Westminster City Council. That Tribunal found that it should be exempt. The City Council thereupon took the matter to the Court of Appeal, which reversed the decision of the Tribunal. In return the Institution carried the matter to the Lords. There, on Tuesday of last week, November 22, the appeal was dismissed. Under the relevent section of the Act of 1843 rating exemption is conferred in respect of "any land houses or buildings . . . belonging to any society instituted for the purposes of science, literature or the fine arts, exclusively . . . provided that such society shall

be supported by annual voluntary contributions". It was held in the judgement of Viscount Simonds, in which Lord Reid, Lord Radcliffe, Lord Tucker, and Lord Denning concurred, that the Institution was not instituted "exclusively" for the purposes of science. Examining the Institution's Charter Lord Simonds found that in listing its objects and purposes it did not use the word "science" except in the phrase "education in engineering science and practice", which indicated the dual character of the education to be given. He held that so far as mechanical engineering connoted scientific work it must involve art and practice also. The structure of the Institution, its avowed purposes, and its actual practice placed it altogether outside the scope of the Act.

Upon the other question, whether the Institution is supported by "annual voluntary contributions" there did appear among the otherwise concurrent judgements a possible shade of difference. Lord Simonds held that where an institution, as in this case, was associated with a particular profession, and the use of initials indicated the attainment of certain qualifications, it was not to be believed that a material benefit was not derived from it through membership. His Lordship concluded that the Institution in a number of ways had regard to the material interests of its members. Lord Radcliffe, however, hoped that the decision, in which he concurred, to dismiss the appeal should not become any final authority about the meaning of the words "voluntary contributions". It seemed to him that there was no rule that a subscription could not be voluntary once any individual benefit was obtained. It was a matter of degree. Having regard to the activities of the Institution the question of whether subscriptions to it were voluntary or not did not properly arise.

In some ways this decision may come as a relief to the Institution. For throughout the protracted litigation the Council has had to weigh the substantial saving of money in prospect, if relief from rates was obtained, against certain limitations upon its activities incurred by the attempt to prove the Institution to be a scientific society; and against other inconveniences arising out of a provision of the Act of 1843 requiring that its hereditaments must be occupied for the transaction of the business of the society and for carrying into effect its purposes, which prevents the building being used for any other purpose, as, for example, through giving aid to another society by lending the meeting hall or other accommodation to it. The decision will certainly come as a relief to some other societies which, had the decision gone the other way, might have felt bound to enter upon litigation to secure similar relief. In August of last year there was published the Report of the Pritchard Committee on the Rating of Charities and Kindred Bodies. In commenting upon the 1843 Act it remarked upon the anomalous situation which had been created by its provisions. "Often we could see no difference between societies within and societies outside the exemption". That Committee made recommendations of such a character that if legislation is founded upon them probably all the major institutions in the engineering and allied fields, not to speak of research bodies, would be relieved of 50 per cent of their rates, without incurring onerous restrictions upon their activities. Now that the possibility of being wholly relieved of rates has been disposed of the Institution of Mechanical Engineers, and others, will look forward hopefully to early action by the Government to implement the Pritchard Committee's recommendations.

T.S.S. "ORIANA"

Tomorrow Saturday, December 3, the maiden voyage of the Orient Liner T.S.S. "Oriana" in the Australia and Trans Pacific Service of the P. and O. Orient Lines will start. This ship, of 42,000 tons gross, has a length overall of 804ft by a beam of 97ft, and a service speed of 27·5 knots and she was named to link the first and second Elizabethan eras. Vickers-Armstrongs, Ltd., built the ship at its Barrow yard and the liner may be entitled the "Ship of the Year", not only because of her outward appearance but for the standard of accommodation offered and the many technical innovations incorporated in the design and equipment. The profile is distinctive and perhaps would have been more distinctive if it had been possible to avoid fitting a second funnel which serves as the engine-room exhaust. Another improvement is the removal of the derrick posts and the housing of the lifeboats at a lower level. The hull form incorporates a bulbous bow designed to improve sea keeping qualities and reduce pitching, while also adopted are twin sets of sideways thrust units, one fitted forward and one aft to assist in docking and other manoeuvres. Air conditioning throughout the ship provides a high standard of comfort for passengers and crew and another item of interest is the speeding up of the movement of baggage by the fitting of a specially designed mechanical system of conveyors and elevators. All cabins are equipped with sound reproduction units and the ship is also fitted with a closed television circuit which can take programmes from stations in Canada, United States, Japan, Australia and Great Britain. There is also a "tele-nurse" automatic baby sitter. All of this special equipment helps to earn the liner its title. Trials have revealed that the ship is free from vibration, a result to which no doubt the fitting of the thrust blocks in the shaft tunnels contributes. The efficiency of the bulk form and the machinery was demonstrated during the trials when a speed of 30·6 knots was obtained with the machinery developing 82,500 s.h.p. on a fuel consumption of 0·46lb per s.h.p. hour.

REPORT ON DATA PROCESSING

A mission of twenty-five European specialists which visited the United States earlier this year under the auspices of the European Productivity Agency, to study progress in integrated data processing, published its report* this week. Some of its findings were commented on by Mr. Brian A. Maynard, of Cooper Brothers and Company (chartered accountants), the leader of the mission, at a press conference on Monday. While finding that impressive attempts have been made by some of the larger American corporations at full integration of all data processing procedures, and others are achieving important schemes within restricted fields, the report notes that difficulties are admitted. One of these has arisen from pressure to go too fast, since a computer manufacturer who has satisfied a potential customer that a computer would be advantageous in a particular application, cannot be expected to recommend that the decision to purchase should be deferred until an adequate survey of all other potential computer applications has been made. As this lesson has been learned, much greater use has been made of consultants in order to gain an overall

*_Integrated Data Processing and Computers_, European Productivity Agency and H.M. Stationery Office, Price 10s. 6d.

assessment of possibilities, rather than plunging at once into a specific application.

The obstacles to success which arise from lack of awareness of the real potentialities of electronic equipment, and the consequent use of old methods on new machines, are now being forestalled in America by an enormous investment in management education. Over 100 university schools have computers, and many more have access to nearby installations, assisted by the generosity of computer manufacturers who have given computers or have lent or hired them on very desirable terms. The result is a flow into industry of young managers who have some conception of what computers have to offer, and many of whom have direct experience of operating them. In view of Mr. Maynard's rather despondent comparison with the corresponding situation in Britain, it is fair to recall that a "Stantec Zebra" computer has just been installed at the Woolwich Polytechnic with the training of students as one of its objects. The Americans had also derived great benefit, Mr. Maynard said, from their Government's pioneer work in data processing. Governments were the biggest data processing organisations in most countries, and Mr. Maynard thought it would be a great thing if, in Britain and Europe, we could organise a degree of co-operation and exchange of information between the appropriate Government departments of different countries. It had to be borne in mind, however, that U.S. levels of salaries, wages and other costs, being twice as high as here, made it easier to achieve sufficient savings to justify installing a computer. On the other hand, the release of some middle management staff from routine duties and their availability for long-term planning would appear to be of equal advantage on both sides of the Atlantic.

Reference was made during the conference to the high proportion of computer costs represented by programming time. Steps towards improving the position are being taken in the U.S.A. by evolving a common language of business terms which computers will be able to translate into the particular instructions they require for carrying out different processes. Now that the first edition of the language has been defined and published, it is expected that the manufacturers represented on the relevant committee will design the necessary translation routines for their machines. Other evidence was also seen by the mission of a trend towards more standardised and economic methods in a field so far characterised by "a quite unjustifiable and uneconomic degree of diversity". The report is brief and specifically written for management. In this way it contributes towards the spread of understanding of its subject for which the need was so strongly emphasised by Mr. Maynard, and may help, in his words, to trigger off in this country an awareness of data processing potentialities a few years earlier than would otherwise have happened. Without this, he forecasts, British management will be badly behind in five years' time when the present nucleus of managers trained in data processing ideas gets down to business in the United States.

HOW TO SAVE MONEY BY SAVING WATER

From time to time in these pages we have stressed the increasing importance of using water over and over again. There are two aspects to this matter. First, we maintain that it is not only disgusting and destructive of a local amenity to pollute a stream or river, but also uneconomic to do so. All waste water, whether domestic or industrial, should be fully treated before the water is returned to the river or stream so that the water can be used again downstream, over and over again. It is, for example, because the strict regulations of the Thames Conservancy keep the Thames relatively pure that London can draw its water supply from that river from just outside — indeed, nowadays from within — the built up area. Secondly there is the aspect that industrial firms using water for certain purposes should recirculate it instead of running it to waste immediately after use. We have been very interested to receive a leaflet on this subject which is being circulated by the City of Birmingham Water Department. It strongly advocates such re-use of water and provides examples of the economies which firms have achieved by doing so. It points out that the City's waterworks have cost over £20,000,000 to construct and cost £1,750,000 annually to maintain and operate and that adding to them must cost a whole lot more. Admirably, it is also pointed out that used water must be disposed of so that additions to waterworks imply expensive additions to sewers and sewage works, all of which has to be paid for in one way or another. It goes on to offer some advice. "First find out how much you are paying directly every year for water supplied and for its disposal. Whatever it is will cost you still more if new supply and disposal works have to be constructed. Therefore, it would be well worth while if you could save up to three-quarters of it, as a number of firms in this city have done, by installing what is, in many cases, a comparatively simple but highly profitable cooling, reconditioning and recirculating plant." The leaflet mentions that forty-two large industrial firms in Birmingham have, by re-using water, reduced their aggregate demands from the Water Department's mains by 2,205 million gallons per year. We commend the action of this City to other cities and municipalities.

The Engineer—100 Years Ago (NOVEMBER 30, 1860)

"Photographic Reproduction Of MSS"

"The reproduction of manuscripts by photography was one of the first applications of Mr. Talbot's method in the very infancy of the art; and since then it has been occasionally practised more or less without leading to any discovery of interest. A curious fact has, nevertheless, been recently brought to light, viz. that photography will revive effaced writings on old parchments. M. Vincent, a member of the Académie des Inscriptions et Belles—Lettres, a short time ago presented to that body the first fac-simile of a MS reproduced photographically by M. Silvy. It was the Sforza manuscript, the original of which is in the possession of the Marquis d'Azeglio; and we need not say that all the designs and ornaments of this precious work have been reproduced with magical fidelity. But the circumstance which deserves peculiar mention is, that not only is the copy more legible than the original, but that certain passages which could not be de-ciphered on the old parchment have been actually revived; and this was particularly visible on the last page, where a note, written in German under the signature, has become both visible and legible, while there is not a trace of it left on the original."

Industrial Value of D.S.I.R. Research—No. II*

POLLUTION FROM ELECTROPLATING WASTES AND FROM OIL—PART II

(*Concluded from page* 895, *Nov.* 25)

At the Water Pollution Research Laboratory at Stevenage a long sustained effort has been exerted to discover methods of treating various industrial wastes so that effluents will not pollute streams or rivers into which they are discharged or alternatively will be accepted by a local authority into the public sewers for treatment at a sewage works. Problems for which acceptable solutions have been found include treatment of electroplating wastes, and treatment of oily waste waters from engineering factories. The work of the Laboratory was first summarised. In the latter part of the article the views and comments of a number of firms are reported and descriptions given of plants in service.

WILLIAM E. FARRER, LTD., BIRMINGHAM

For many years this firm has been supplying equipment for the treatment of domestic sewage and has naturally, therefore, applied its previous experience to the design and installation of plant for the treatment of industrial effluents. In treating such wastes the methods it recommends are often similar to those recommended by the Laboratory. Its representative emphasised that although in many cases industrial effluents may be similar in character, each treatment plant must be designed to suit the particular requirements of the client and the site. Experience has shown that where considerable flows are involved, continuous flow plants are the more economical, both in cost and size, but, nevertheless, in some cases, batch treatment is still the more favourable proposition. Given correct design and adequate consideration, in the firm's view, there is no reason whatever why a continuous plant should not produce an effluent quite as satisfactory as that discharged from a batch plant ; and indeed the partial elimination of the human element, when provision is made for adequate warning safeguards, is regarded as an advantage.

It is, however, usually desirable to discharge the treated effluent to a foul sewer rather than to a water course. The standards required by the River Boards for discharge to a river are so high that if they are to be met, very close control must be exercised over the treatment processes with the result that the treatment plant becomes more costly.

Probably the most common effluent problem which is encountered is that which arises from the metal-finishing processes concerned with plated articles. Considerable experience has been gained in the treatment of such effluents which usually can be sub-divided into acid wastes, containing chromates, and alkaline wastes, containing cyanides. Almost invariably it is necessary to separate such discharges into two separate drains, since the treatment requirement is essentially different in each case.

Normally, acid chromate effluents are first treated by the addition of sulphur dioxide at a low pH value in order to reduce the chromate. The cyanide effluent, however, can effectively be treated by the addition of chlorine at a high pH value. Since the one process is reduction whilst the other is oxidation, it follows that the two operations cannot be carried out simultaneously. After the separate pretreatment, the two effluents can be combined for mutual neutralisation together with the addition of an acid or alkali in order to achieve the desired pH value. Frequently, it is desirable to provide settlement in order to remove the toxic metal content.

Fig. 5—This continuous treatment plant is capable of handling a flow of 7000 g.p.h. of mixed effluents from a motor car accessory firm

The precise requirements of such a plant obviously vary from factory to factory and the point was emphasised by the firm's representative that it is very desirable when plant, which may produce an effluent requiring treatment, is to be installed, that consideration should be given to the requirements of the effluent treatment plant at the earliest possible stage. At such a stage, it is usually much easier to arrange plant so as to facilitate the drainage layout and the maximum co-operation of the effluent treatment engineers can be assured. In many cases, it is found that to the factory engineers concerned, the requirements of such a plant are new and early discussions can in many cases result in a more economical layout of plant.

Obviously, it is desirable at the earliest possible stage to determine the constitutents of any particular trade effluent and this firm retains the services of a well-known firm of analytical and consulting chemists to assist in the determination of the desirable treatment processes. Other bodies have also at times been consulted and advantage is taken of every possible source of information.

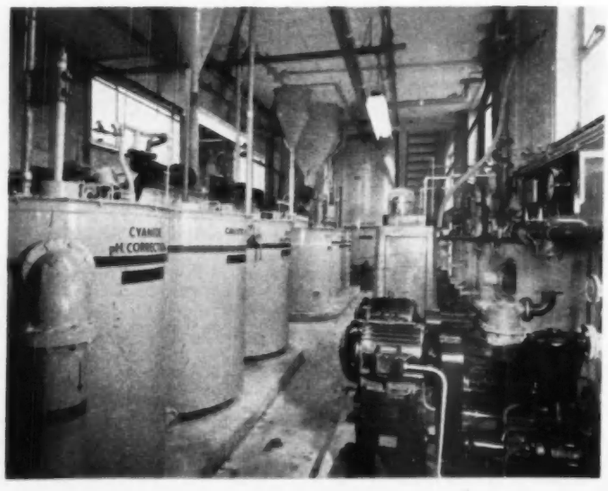


Fig. 6—Interior of continuous treatment plant at Liverpool

* The first article in this series related to the work of the National Engineering Laboratory on certain aspects of Hydraulics. It was published in our issues of April 29 and May 6, 1960.

Although the requirements of a treatment plant can be determined theoretically, there are many instances where experience is as valuable a guide and indeed there are several cases where the firm's experience has shown that the accepted practice is by no means the only satisfactory one and alternative methods have been applied with considerable success, resulting in reduction in cost and less difficult maintenance.

The two photographs reproduced in Figs. 5 and 6 show a large continuous treatment plant installed at a motor-car accessory firm near Liverpool. The plant deals with continuous discharges of swill waters, acid chromates and caustic cyanides being pretreated before being combined for common neutralisation. The treated effluent is discharged to circular settlement tanks for the removal of the suspended solids before the clarified effluent is discharged to the town sewers. Strong liquors which are periodically discharged are blended under automatic control with the swill waters ; and also incorporated is a semi-automatic batch plant for the treatment of soluble oils. Cyanide is destroyed by the controlled addition of chlorine, whilst hexavalent chromium is reduced to the trivalent condition prior to neutralisation by the controlled addition of sulphur dioxide. Both these processes are carried out at their respective optimum pH conditions, the necessary pH correction equipment being incorporated in the plant prior to the gas injection.

All the electrical and electronic control equipment is incorporated with one common panel, electrical interlocks being provided together with an adequate warning system. The gases, purchased in drums, are stored in the single-storey part of the building, whilst the remaining reagents, lime, caustic soda, &c., are stored in the upper floor which also accommodates a small laboratory for the use of the operator.

The plant is handling a flow of approximately 7000 g.p.h. and it is understood that the effluent being discharged is well within the requirements of the Local Authority.

Tecalemit, Ltd., Plymouth

This firm operates a treatment plant with a throughput of 60,000 to 70,000 gallons per day. The original neutralisation station was built in 1949 at the time the new Tecalemit factory was built at Plymouth, Devon. It was designed and built by the firm itself. In the design of the new plant wide use was made of advice from the Water Pollution Research Laboratory which Tecalemit Ltd. had also consulted on various occasions prior to moving to Plymouth.

A batch treatment method was decided upon. The factory waste waters consisted of an alkaline effluent containing cyanide, and of an acid effluent containing chrome. The cyanide effluent was treated with sodium hypochlorite solution which was received in carboys. Excess chlorine was made harmless by the addition of sodium thiosulphate.

The acidic effluent was treated with ferrous sulphate to reduce chromium compounds to chromates. The two waste waters, alkaline and acidic, being of approximately equal volume, were then transferred into a settling tank to enable solid matter to precipitate. The supernatant neutral water was then discharged into the factory sewers, and from there, together with the factory sewage, pumped to the nearest city sewage works.

In 1953 it became clear that the original neutralisation station had reached the limit of its capacity. The factory production had increased so much that the single settling tank was not sufficient, and in order to avoid discharging waste containing too high a proportion of solid matter a second settling tank had to be built. In connection with this the whole plant layout was reviewed and various other improvements introduced. Again, useful information was gained from publications of the Water Pollution Research Laboratory, and the Director of the Laboratory was consulted on several points. The

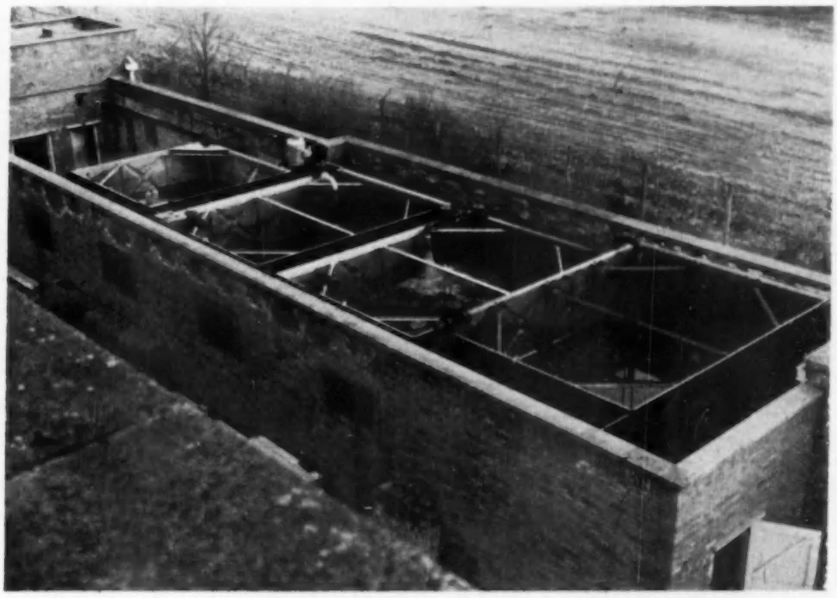


Fig. 8—Waste water treatment plant at Tecalemit Ltd., Plymouth, is an excellent example of a small plant. On the left can be seen the entrance to the laboratory and to the chemical storage and mixing room. The small tank on the left is the cyanide reaction tank. The two tanks to the right are settling tanks

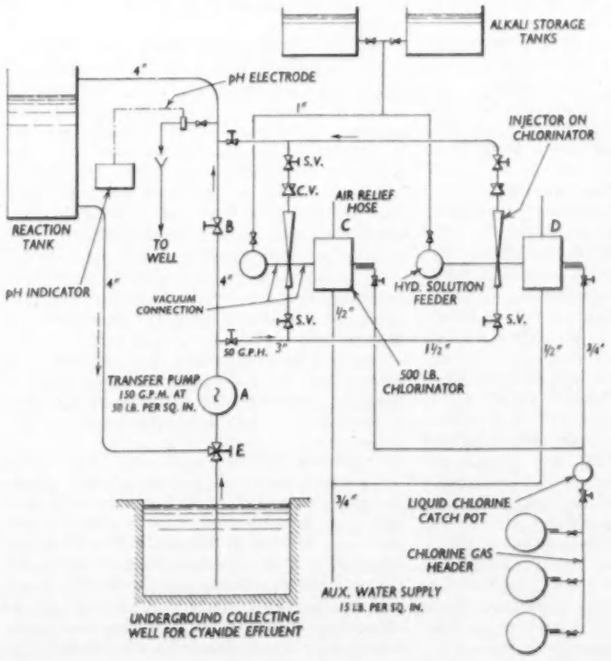


Fig. 7 — Layout of chlorination treatment of cyanide effluent at Tecalemit Ltd.

Fig. 9—The draining pipes and valves from the four tanks can be seen. At the bottom left is the channel leading to the factory sewer

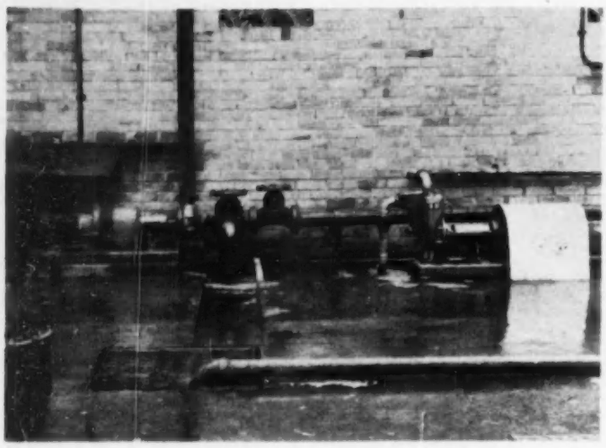


Fig. 10 (Left)—This shows on the left the cyanide effluent transfer pump. The unit on the right of it is an emergency pump held in reserve in case of a pump breakdown. Fig. 11 (Right)—The pH meter on the wall of the plant laboratory, adjacent to the chemical dosing room

Fig. 12—Chlorine is purchased in 16 cwt-17 cwt drums. Great care is required in handling, connecting and disconnecting these drums, and existing safety regulations, such as wearing a gas mask, are strictly observed. The temperature of the separate chlorine storage room is thermostatically controlled

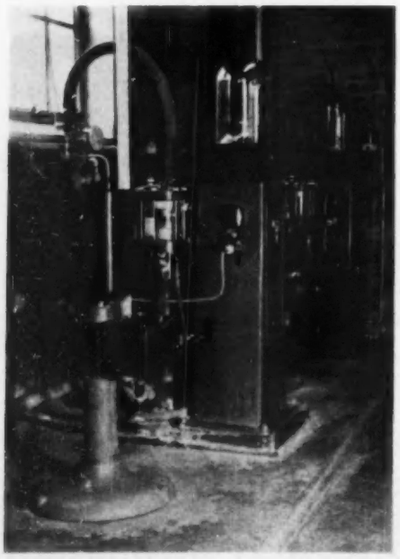


Fig. 13—The two chlorine gas dosing units made by Wallace and Tiernan, with their inverted glass bells. In front a solutioniser is visible for the addition of caustic. Both solutionisers are fed from an overhead tank. The temperature in this room also is thermostatically controlled

modifications included :

(*a*) Doubling the capacity of the underground waste collecting wells.

(*b*) Installation of greater capacity transfer pumps for alkaline and acid wastes.

(*c*) Cyanide treatment by chlorine gas.

(*d*) Installation of pH meter to indicate state of treated cyanide effluent.

(*e*) Draw-off of clean effluent after settling by floating outlet.

The most important and costly item of the modification was the new chlorination plant. A diagram of this plant is shown in Fig. 7. Briefly, the cyanide wastes drain by gravity into an underground collecting well. When the well is full, pump *A* is started. The water is pumped via pressure reducing valve *B* to the " reaction tank." A portion of the water is shunted off to the chlorinators *C* and *D*. Here the chlorine gas is dosed into the effluent and at the same time caustic soda solution added to ensure a pH of not less than eleven, essential for quick and complete conversion of the cyanide into innocuous cyanate. Two chlorinators and two caustic solutionisers are provided so that comparatively high concentrations of cyanide can be treated in one passage. Moreover, the plant is arranged in such a way that it is possible to recirculate, via valve *E*, the contents of the reaction tank through the chlorinator plant should the check of the contents in the reaction tank indicate that this is necessary. The satisfactorily treated cyanide effluent is pumped into an empty settling tank.

The acid effluent from the factory is collected in an underground well of the same capacity as that of the well for the cyanide waste. It is treated there with ferrous sulphate and pumped into a reaction tank. When the reaction is complete, the acid waste is added to the treated cyanide effluent in the settling tank. This procedure ensures that the pH of the mixed effluent in the settling tank approaches neutral from the alkaline side, an essential condition for rapid flocculation of the solids. When the settling tank is full it is first checked for pH and then allowed to settle for three-quarters of an hour. The water is substantially freed from sediment and is discharged to the factory sewers.

To keep the plant going one operator must be in attendance whenever the factory is operative. He is responsible for initiating the transfer of fluid from the underground wells to the reaction tanks, for the adjustment of the chlorine gas and alkali dosing equipment, for the transfer of fluid from tank to tank, &c. He is also responsible for making tests on the effectiveness of treatment. In case of need the operator calls in the aid of the works chemist. The plant is illustrated by Figs. 8 to 14.

In addition to these check tests, regular control samples are examined in the Chemical Laboratory of the factory. A variety of tests are carried out weekly and monthly to ensure that the waste water released from the factory is neutral and in agreement with the requirements of the Local Authority.

Advice on the laying out of the plant was received from Wallace and Tiernan, Ltd., which supplied certain items of plant, and from I.C.I., Ltd., about the usage of chlorine.

On research matters in general the firm's representative remarked upon the difficulty nowadays of keeping up to date with the flow of information about any subject. The apparent ease with which the firm adopted advice from the Laboratory may perhaps be partly explained by the fact that he had had a good deal of research experience himself.

Ronson Products, Ltd., Leatherhead

This firm has much plating work to do in the manufacture of its well-known cigar and cigarette lighters and other smokers' requisites. Output at its Leatherhead factory is rapidly increasing. Up to the date of our visit the problem of effluent disposal had been met by dilution and automatic neutralisation of acid effluent, bulk discharges being treated on site and cyanide liquors treated with sodium hypo-

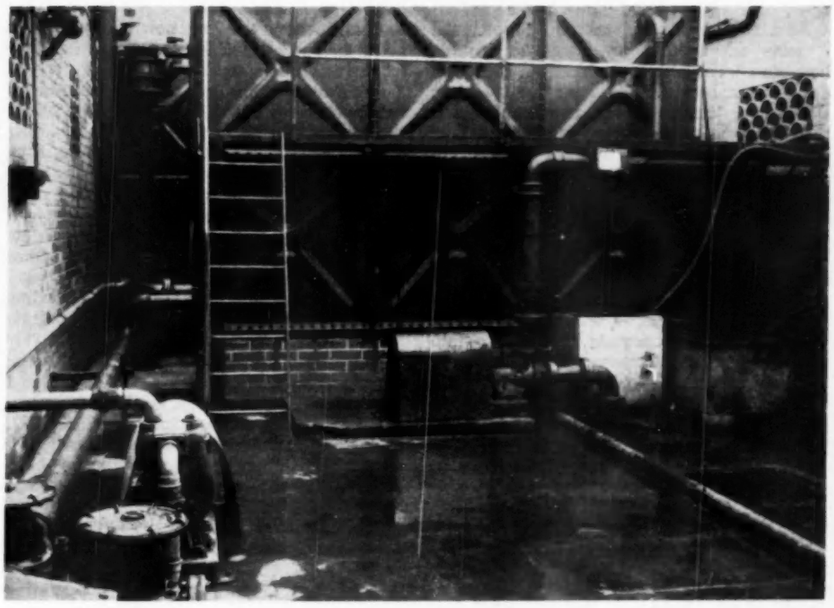


Fig. 14—One side of the cyanide effluent reaction tank. The unit in front of it is the acid transfer pump and the little white container on the right is used for dosing ferrous sulphate solution to the underground well beneath it. On the left, between tank and wall, the large capacity transfer pump is visible.

chlorite to make them non-toxic. However, the disposal of wastes in this manner has been found to be expensive in labour and water and to alter this the company has recently approached a number of makers of effluent plant. Through one of those makers it was put in touch with the Water Pollution Research Laboratory. It was itself aware of the existence of the Laboratory before that time having seen it mentioned in trade literature, but not fully aware of the work it carried out. In conjunction with the makers of treatment plant the problem was put to the Laboratory, which examined the chemical constitution of the effluents checked upon quantities, &c., and commented on the detail designs prepared by the plant manufacturers, e.g. location of weirs, sizes of settling tanks, &c. The Laboratory, it was pointed out to us, does not, itself, design plants, though it is always willing to express an opinion about features of designs.

That was as far as the matter had gone at the time of our visit. A design approved by the Laboratory was in being. But no contract had been entered upon nor had any plant been made.

Upon being asked what had prompted this activity the firm's representatives said they had never been in any trouble with the local authority. But as they were aware that recent legislation had given the authorities new powers ; and because they certainly did not want to risk having the operation of the factory stopped ; and because they did want to continue to discharge their wastes to the sewers, they wanted to find out how best to deal with the problem. The local authority laid down what strengths of effluents could be accepted into the local sewers. It was proper that it should do so. But for their part they did wonder whether the requirements were not unnecessarily stringent in asking, for example, that all acid effluents from the works should be neutralised before discharge to the sewers. The point was made that in an area such as Leatherhead the domestic wastes in the sewers would flow in large quantities and be quite strongly alkaline so that the engineer at the local sewage works might welcome some reduction of that alkalinity by a trade waste.

Imperial Chemical Industries, Ltd.

Only a very small amount of electroplating is done at one or two works of this company as part of more extensive metal treatment activities. The methods of waste treatment used at these works are primarily designed for the removal of substances other than cyanide, although the treatment given does, in fact, deal with cyanide at the same time. The chlorination process has little application for cyanide treatment in these cases. It should, however, be mentioned that I.C.I. is interested in the chlorination process as a seller of chlorine. The company was, in fact, selling chlorine for treatment of cyanide effluents many years before the Water Pollution Research Laboratory began its investigations into the fundamental chemistry of the process, but it is not thought that the subsequent elucidation of the chemical reactions by W.P.R.L. modified I.C.I.'s ideas as to the correct method of using chlorine for destruction of cyanide in a plating waste.

With regard to oil separation the firm's representatives did not agree with the implication that little information on how to separate oil was available before D.S.I.R. looked into the problem. As might be expected, they pointed out, American oil companies have been concerned with this subject for very many years. Standard designs of oil separators for refinery waste waters were published by the American Petroleum Institute nearly twenty years ago. Many people in this country have adopted A.P.I. standards (which are revised from time to time) and a number of separators of the A.P.I. design are in use in various works of the company.

They appreciated, of course that this article is specifically concerned with oil from engineering works. Here, again, dealing with the engineering shop effluents within chemical factories is only a minor part of a much bigger problem and the methods used for treating such a shop effluent would be designed in relation to the treatment and disposal of the effluent from the remainder of the works. Thus it would not necessarily be advantageous to employ "improved" methods of the type worked out by the W.P.R.L.

The firm's representatives went on to remark that the company has a high regard for the quality of the work that is done by W.P.R.L. in, for example, the biological and micro-biological field, the fundamental investigations that have been carried out on the oxygen balance in rivers and estuaries, the fundamentals of aeration both of effluents and in natural waters, and many others. Close contact is maintained between I.C.I. specialists concerned with these subjects and the Laboratory, and mutual benefit is derived from frequent meetings and correspondence.

Views of a Consulting Engineer

During the war the Ministry of Aircraft Production asked the Water Pollution Research Laboratory to carry out investigations to prevent, among other things, the pollution of streams by oil from engineering works. A firm of consulting engineers collaborated with the laboratory in carrying out the work, the results of which have been recorded in an article in *Engineering* (June 20 and 27, 1947).

In the case mentioned it was the research laboratory that asked that consultants should be brought in, feeling, no doubt, that consulting engineers would be better able to design full scale plant than research workers, more accustomed to laboratory equipment. In other cases a firm of consultants has been approached by a manufacturing firm and has then advised that the research laboratory should also be consulted. But little recent design work for the treatment of plating wastes or oils appears to have been done by consultants, possibly because specialist suppliers can now make suitable plant. But they are often consulted and are sometimes instrumental in getting plant modified and in putting firms into touch with the research laboratory; of the value of whose work on these and other subjects the consulting engineer we interviewed had no doubt whatever.

He regarded it as rather unlikely that a manufacturing firm, without outside assistance, could devise for itself a satisfactory treatment plant for its own wastes. The reason is that the firm's chemists are primarily concerned to promote the firm's production of whatever it makes ; that is assuming it has any chemists on its staff at all. It does not at all necessarily follow that a chemist versed in plating problems will have any knowledge or experience of the treatment of plating wastes. Thus firms having industrial wastes to dispose of tend to go to specialist firms to obtain suitable plant. As a general rule the consultant's advice to firms installing new plant is that the plant shall be of the batching variety in the first instance. Plant which will give continuous treatment is, of course, more attractive as it needs less attention. But until a plant has been operating for some time it is often impossible to estimate to what degree the rates of flow of effluent may vary nor how substantially its chemical character may change hour by hour. A batching plant can ensure that whatever the variations the treatment will be satisfactory. Conversion to continuous operation may be possible later.

Several points which illuminate the situation in relation to the pollution of streams and rivers were mentioned by this consulting engineer. Even though they may be deemed a little irrelevant to the purpose of this article they still seem worth reporting. Very often the managements of firms have no realisation of the dangers of pouring what appear to be small quantities of effluents into local watercourses or into the sewers ; nor do the firm's chemists always know at all accurately what the effluent is composed of. It is not always appreciated, for example, that a cyanide solution of a strength of as

little as 0·1 part per million is toxic to fish. To managements, again, the question of the disposal of an effluent ranks as a very minor matter in relation to the reality of the production to be carried on in the factory. Similarly, the makers of plant such as that installed in a plating shop are not primarily concerned to reduce the amount of effluent coming from it or to reduce the toxicity of that effluent. Nor, interestingly enough, are local councils always aware of the danger that a comparatively small amount of effluent from a new factory attracted to the area may adversely affect the operation of the local sewage plant and perhaps involve it in substantial expense ; or that if discharged to the local stream it may destroy it as an amenity. To the managements of firms, of course, the construction of a treatment plant ranks as a dead loss. In the circumstances —the comment is ours—it seems very fortunate that bodies such as River Boards exist which can act as critics !

As a rule a firm will take no action until it runs up against (or foresees) trouble because a local authority objects to accepting an effluent into the sewers ; or a River Board or a riparian owner draws attention to the state of a watercourse. It will not take any action, not because it is evil-minded, but because it is unlikely to appreciate that any action is needed.

A special situation has been created in the various new towns which have been set up since the war. Right from the start the development boards have asked firms wanting to set up factories in such towns what wastes they will want to discharge. They have also appointed public chemists to examine into such matters ; and studies of the treatment of wastes are carried out in conjunction with the Water Pollution Research Laboratory. If the board is unable to accept an untreated effluent the firm concerned is encouraged to go to a suitable plant manufacturer or to employ consultants.

Diesel Locomotives in the United States

By H. F. BROWN, Ph.B., A.I.E.E.

A paper entitled " Economic Results of Diesel Electric Motive Power on the Railways of the United States of America " was presented to the Institution of Mechanical Engineers on Wednesday, November 30, by Mr. H. F. Brown, a consulting engineer with Gibbs and Hill Inc., of New York. This paper gives details of a study which has led to the conclusion that, despite popular belief, the all-embracing economies claimed for diesel motive power are unfounded and, in fact, that diesel motive power has added to the financial burden of railways in the United States. This paper is arranged in two parts—Part 1 : " Economic Conditions and General Statistical Data "; and Part 2 : " Economic Results of Diesel Electric Locomotive Operation." Our notes from the paper give first the introduction from Part 1, followed by abstracts from Part 2.

THIS study of the economics of diesel motive power is based mainly on data contained in the " Statistics of Railways of the United States " published annually by the Interstate Commerce Commission.

The decisions by the various railways to make the change from steam to diesel power were based largely on the operating economies made by the relatively few units placed in yard and in road service during the period 1935–46. These economies appeared so large in comparison with the costs of existing steam operation at that time, that the question of steam versus diesel has been regarded as a closed issue, and of but academic interest in the United States of America since 1950.

However, by 1955 it was becoming evident that a number of factors pertaining to the economics of diesel operation had not been fully known as early as 1945–50. To-day, with nearly twenty years of diesel operation, these factors can be more clearly defined. During these years, and for at least two decades prior to these years, other important factors have been shaping railway economics in the United States.

The problem, in this study, has been not only to isolate the motive power statistics, which are quite complete for both steam and diesel motive power, but also to show enough of the general operating and traffic data to enable the identification and evaluation of these other important economic factors, the results of which have been often attributed to diesel operation.

In the final analysis made in this study, the costs of the actual diesel operations for the year 1957—the latest available at the time this study was made—are compared with the similar costs of hypothetical operations with equivalent steam power, of modern design and of the same average age, sufficient in numbers and capacity to handle the same amount of traffic. Such steam power, of necessity, would have been installed, had the diesel not been available. By such a comparison, many of the other contemporaneous factors which have confused the true picture of diesel operating economies are eliminated.

This study is not to be construed as advocating a return to steam operation. Its sole purpose is to determine the economic position of diesel motive power with respect to other types whose economies are known, or yet to be determined.

The Change from Steam to Diesel Motive Power

The diesel electric locomotive made its initial appearance on the United States railways in yard service in 1925, but fewer than 100 such units were acquired during the next ten years. By the end of 1939, there were about 435 diesels in yard service and about ninety in road service—too few to have any noticeable effect on the general railway economy.

After the 1939–45 war, the automotive industry started an active campaign to sell the diesel locomotive to the American railways. The time was most opportune because of the age and general worn-out condition of the steam motive power.

The first road diesels were used in preferred passenger service on long runs, and on lines having stiff gradients. It was quickly found that in such service this new motive power could be used to the limit of its availability, which was quite high.

High annual mileages per unit were being made. Grades could be negotiated without the former " helper " service required. Fuel costs were low, with diesel oil then at four cents per gallon. Thermal efficiencies were about four times better than steam in road service, and up to ten times better in yard service. Maintenance costs of this new power compared with the old steam power were quite low.

The steam locomotive almost immediately became outmoded by the testimony of its former manufacturers, then all competitively engaged with the automotive industry in the manufacture of diesel power. About 8000 diesel locomotives had been acquired prior to 1949. During the years 1949–52, more than 12,500 units were acquired ; and since 1952, about 7000 more have been acquired up to the end of 1957. No steam locomotives have been built in the United States since 1952. One of the largest manufacturers stopped building steam locomotives in 1948.

The class 1 railways are all operating to-day with most of its motive power relatively new, compared with that in service prior to 1945.

Basic Differences : Steam and Diesel Electric Motive Power

Diesel locomotives have operating characteristics fundamentally different from those of steam locomotives. These must be understood before the operating economies can be appraised. Diesels are more nearly like electric locomotives, limited, however, by the capacity of their own power plant.

The steam locomotive develops its maximum horsepower at near its full speed. At starting, the boiler can generate steam faster than the cylinders can use it. The cylinder pressure and wheel diameter determine the maximum starting tractive force, within the limits of adhesion. At high speed, the boiler horsepower determines the tractive force.

The diesel engine is a constant-horsepower machine. With its electric drive, which is simply a " torque converter," the engine can be operated at full speed at starting, and nearly its full horsepower can be converted into tractive force, also within the limits of adhesion.

The comparative horsepower and tractive force curves for a diesel and steam locomotive having equal weight on drivers are shown in Fig. 1. In this case more horsepower can be built into the steam locomotive than into the diesel. The diesel still has a higher starting tractive force up to about 6 m.p.h., but above 20 m.p.h. the steam locomotive has double the tractive force of the diesel.

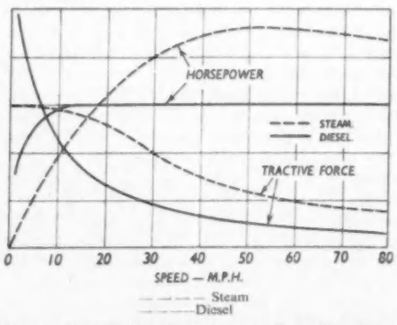


Fig. 1—Comparative horsepower and tractive force, steam and diesel locomotives of same weight on drivers

American manufacturers have not been able to build a single diesel unit having much more than 2000 h.p. delivered to the rim of the driving wheels. The average diesel locomotive will produce about 14 h.p. per ton of its weight.

The superior performance of the diesel at slow speeds is one reason why it was adopted so rapidly in switching and yard service, where speeds average but 6 m.p.h. The diesel became popular also on the railways having heavy mountain grades, because by slowing down, the diesel can increase its tractive force to a greater extent than can a steam locomotive.

Starting tractive force, however important, is but a short part of the time of the total road performance. Horsepower is required for speed, and single diesel units cannot produce the horsepower that modern steam or electric locomotives can supply in single units.

The tractive force rating usually given for any locomotive is that for starting. This can be quite misleading in the comparison of types, for it overrates the ability of the single diesel unit. The important tractive force required in road service is that for accelerating and moving the train load at the schedule speed. This requirement is independent of type of motive power. Any locomotive can usually keep moving any train it can start. The criterion is "Can it bring that train up to the desired speed, and in the desired time?"

The True Number of Locomotives

The I.C.C. statistics for 1957 show that it required 2·08 diesel units per average passenger train, and 2·59 diesel units per average freight train. The average for all trains in road service was 2·41 units. The tractive force of any of these combinations at the running speed is well within the capacity of most of the modern steam power remaining in either passenger or freight service in 1957.

This leads to the interesting conclusion that it has required more motive power units of the diesel type to perform the present transportation service on the class I railways than would have been required had modern steam locomotives been purchased in their stead. The actual number of diesel locomotives in road service in 1957 was not the 18,959 diesel units given in the statistics, but was this number divided by 2·41, which is 7870 locomotives.

The true reduction in number of locomotives caused by the traffic losses, and the changes in operating patterns and methods made to meet these losses is shown in Fig. 2 by the dotted graph, which departs from the solid graph for numbers in 1941 and drops to 10,330. This is the theoretical total number of all road locomotives in service in 1957.

Availability: Diesel and Steam Locomotives

New diesel locomotives have an availability as high as 90 per cent. Modern steam power has an availability of at least 60 per cent when new. The availability of all motive power is reduced as it becomes older.

Availability is of no great value beyond the utilisation that can be made of the motive power. The high utilisation made of the diesel power in selected service during its earlier years has been reduced, as diesels increased in numbers. This is indicated in the Table by the approximate annual mileage for diesel locomotives, which dropped from 101,000 in 1953 to 86,500 in 1957.

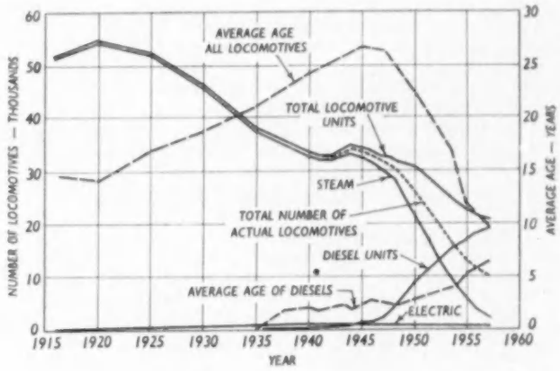


Fig. 2—Road locomotives on all class I railways

To establish a basis for comparison of operating costs and investment, it may be assumed that the number of modern steam locomotives equivalent to the road diesel locomotives is inversely proportional to their availabilities. This assumption is favourable to the diesel.

Then 7870 times 1·5 or 11,800 steam locomotives would be the hypothetical equivalent of the 18,959 diesel units in road service in 1957.

Effect of Diesel Operation on Number of Trains and Train-Miles

It is claimed that the large reduction in the number of trains as indicated by the reduction in train-miles since 1946 has been due to the multiple-unit operation of diesel units, which has enabled the operation of longer and faster trains in both freight and passenger service. This in turn has allowed a large reduction in the number of trains, thereby making large savings in operating labour. This claim is given great emphasis by the diesel manufacturers, and considerable credence by the general public.

It does seem plausible to relate the large drop in train-miles after 1946 to the known substitution of diesels for steam, as shown in Fig. 2, during this same period. Nevertheless, a little analysis will show that these facts are not at all related to each other.

Consideration of Fig. 3 shows that at least two diesel units are required to perform the service of the largest steam power installed between 1920 and 1930, and up to five units to equal the largest steam locomotives built after 1930. Ever since the introduction of diesel motive power in road service, the multiple-unit operation of two or more units has been a necessity to equal the horsepower of the steam locomotive replaced. Multiple-unit operation is not a virtue, except where "double-heading" or "helper service" can be eliminated, or reduced. It does provide also for some flexibility for maintenance.

There are two possible explanations for the large drop in train-miles since 1946:

(1) The increase in cars-per-train and in tons-per-train could be caused by the consolidation of two or more trains into one much longer train, with a reduction in the number of train-miles. This would call for an increase in the number of diesel units per locomotive nearly proportional to the reduction in the number of train-miles, in order to justify the above claim.

(2) The same increase in cars-per-train and in tons-per-train, with the same reduction in train-miles could be due to the withdrawal of the many short trains on branch lines and to loss of the short-haul traffic on the remaining trackage. The remaining traffic would be handled by trains of no greater maximum length than before, yet the total cars-per-train and tons-per-train would show a rise due to the elimination of the shorter trains which made up the average. In this hypothesis, the number of diesel units per locomotive would show only a slight increase.

Data on diesel unit-miles are not available prior to 1953. In the table are shown the diesel-operated train-miles, locomotive-miles, and diesel unit-miles in freight and in passenger service for the years 1953–57 inclusive. Freight train-miles decreased 10 per cent during this period, gross tons per train increased 12·3 per cent, and cars per train 9·3 per cent. Units per locomotive, however, increased only 5·3 per cent. These

Diesel Operating Statistics 1953-57

All locomotive- and train-miles in millions

	1953	1954	1955	1956	1957	1953 against 1957 Increase, per cent	1953 against 1957 Decrease, per cent
Freight :							
Diesel locomotive-miles	375	391	428	446	438	17	
Diesel unit-miles	921	964	1054	1113	1134	23	
Units per locomotive	2·46	2·46	2·46	2·50	2·59	5·3	
Diesel train-miles	358	374	409	424	417	16	
Total freight train-miles	492	447	476	475	447		10
Cars per train	64·0	65·6	66·2	67·6	70·0	9·3	
Gross tons per train	2870	2900	3000	3100	3220	12·3	
Train-miles per train-hours	18·2	18·7	18·6	18·6	18·8	3·5	
Passenger :							
Diesel locomotive-miles	244	251	244	243	233		5
Diesel unit-miles	493	506	497	502	483		2
Units per locomotive	2·02	2·02	2·04	2·07	2·08	3	
Diesel train-miles	239	246	239	239	229		4
Total train-miles, locomotive propelled	302	288	271	261	245		23
Total passenger train-miles	333	317	299	290	275		21
Cars per train	10·0	9·7	10·1	10·3	9·8		2
Train-miles per train-hours	39·1	39·5	39·8	40·0	40·2	3·5	
Total :							
Diesel locomotive-miles	619	642	671	689	671	9	
Diesel unit-miles	1413	1470	1551	1615	1617	14·5	
Units per locomotive	2·29	2·29	2·31	2·35	2·41	5	
Train-miles, all	826	764	776	766	722		15
Diesel :							
Average miles per locomotive, thousands	101	95·0	93·5	91·5	86·5		17

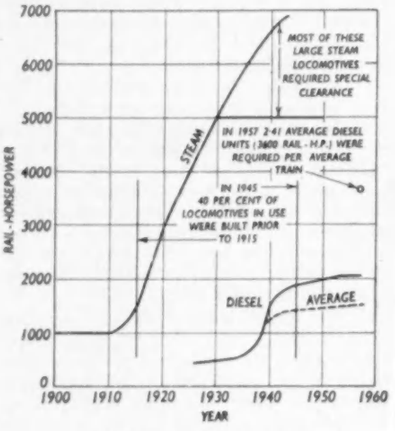
statistics indicate improved operating skill in the loading of cars and trains, but this is independent of the type of motive power.

In passenger service, train-miles (locomotive-propelled) decreased 23 per cent, cars per train decreased 2 per cent, but units per locomotive decreased only 3 per cent.

It is quite obvious from the table that the data fits explanation (2) rather than explanation (1), and that this entire claim for the diesel is invalid.

The average of ten cars per train in passenger service, and seventy cars or 3200 gross tons per train in freight service are no greater than could have been handled by any average steam or electric locomotive remaining in service in 1957.

The Table also indicates that the diesel, *per se*, has not been responsible for the slight increase in average speed shown. It



Available at rim of driving wheels.

Fig. 3—Development of maximum locomotive rail horsepower

is probable that this increase is due to the elimination of slower trains and intermediate stops, together with improved dispatching and signal systems. Also, the elimination of passenger trains allows faster average freight train speeds.

In Fig. 4 are shown comparative repair costs in cents per 1000 rail horsepower-miles, related to age, for steam, diesel, and electric locomotives. The steam curve is adjusted from 1929 to 1953 price levels. The electric graph is from costs on two class I railways operating similar electric motive power designed around 1938. The diesel graphs are from studies made in 1955 of repair costs related to age of more than 3000 diesel units of all ages up to twelve years (on seven class I railways). All costs are shown in 1953 price levels.

The graph marked *A* is based on calculated diesel repair costs for an economic life of fifteen years. Point *P* is the calculated repair costs in cents per 1000 rail-horsepower-mile incurred by all the road diesel power on the class I railways in 1957, adjusted to the 1953 price level. The average age of this diesel power was 6·6 years in 1957. The point *P* falls almost exactly on the graph *A*, at 17·8 cents.

Steam repair costs at age 6·6 years are 78 per cent of diesel repair costs shown in graph *A*. Road diesel repair costs in 1957 were 377·4 million dollars. Equivalent steam power of the same age, to perform the same number of horsepower-miles, would cost 377·4 dollars × 0·78 or 293 million dollars.

In 1957, diesels in yard service had an average age of nine years.

Summary of Savings with Diesel Electric Motive Power

The summary of savings for all the items of locomotive operating expense shows that the diesel locomotives, *in toto*, made operating savings of 137 million dollars compared with the assumed equivalent steam operation, on the basis of 1957 costs. For each year in retrograde prior to 1957, the savings would be correspondingly less.

The total investment is 1·8 billion dollars greater for the diesels, and the fixed charges are 165·5 million dollars greater than for the equivalent steam locomotive investment, exceeding the operating savings by 28·5 million dollars.

In road service alone, the investment in diesels and pro-rated facilities is 1135 million dollars more than for the equivalent modern steam power. Diesel operation is 49·7 million dollars cheaper than steam operation, but fixed charges amount to 71·6 million dollars more than the operating savings.

In yard service alone, the investment in diesels and pro-rated facilities is 665 million dollars more than with equivalent steam power. Diesel operation is 87·3 million dollars cheaper than with steam operation, and fixed charges are only 44·2 million dollars greater than for steam, making a net overall saving of 43·1 million dollars. This is 6·6 per cent return on the 665 million dollars increase in investment.

Quite obviously, the savings realised by diesel operation in yard service have not been realised in road operation. It is clear in the development of the analysis just why this has not been possible. Nothing can be found in this analysis to justify the claim so often made that the diesels are producing a 30 per cent return on their investment. If this were true, such large savings would become apparent in lower operating ratios, and in increased earnings.

Although the diesel is a cleaner type of motive power than the steam locomotive, it still requires expensive ventilating equipment in long tunnels and is excluded from operating in large enclosed or built-over urban terminals. Any savings resulting from the through diesel operation of former short electrified sections in tunnels are included in the general statistical data studied.

Diesel locomotive design has proved, as electric locomotive design has proved in

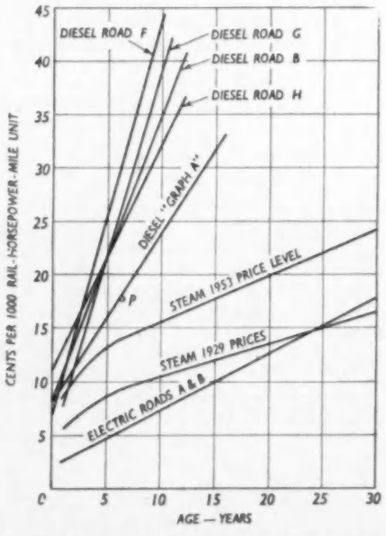


Fig. 4—Comparison of steam, diesel, and electric locomotive repair costs on basis of 1953 price level

Europe, that high speeds can be safely made with locomotives having small-diameter-driving wheels without the necessity of idle leading axles. Thus all of the locomotive weight may be used for adhesion. Small-diameter driving wheels, and lower centre of gravity do produce greater track and rail stresses. Rail " burns " from slipping driving wheels are more prevalent with diesel operation than with former steam. It is often claimed that the change from steam to diesel has reduced the cost of track maintenance. Maintenance of way costs have been carefully examined over the period studied to verify this claim. No indication can be found that the change in type of motive power has produced any savings in this field. Such costs have increased slightly.

During the period since 1940, railway management has been beset with many serious problems, including increased competition with subsidised carriers, loss of traffic, rising costs, and higher operating ratios. To solve these problems management has changed operating methods, made large investments in new motive power, cars, and facilities, in improved freight terminals and yards, in new signals and dispatching systems, and in general improvements in way, and in maintenance methods.

In this period the total investment in the classes I and II railways has been increased to 9 billion dollars, or more than one-third. Of this increase, motive power and facilities have accounted for 2·5 billion dollars ; new cars, 4 billion dollars ; with all other improvements accounting for the balance of 2·5 billion dollars. The investment in diesel motive power has been the most spectacular, and has had the greatest amount of publicity.

To claim, however, that the diesel is responsible for all the operating economies made since 1935, or even 1945, is to belittle the skill of management, and to expropriate the credits due to these other investments.

Such claims cannot be made equitably for any one factor. All have made their contribution.

This study simply states that the all-embracing economies claimed for diesel motive power do not appear in the statistical record.

The diesel locomotive has not " revolutionised " American railway economics. In road service, diesel motive power has added to the financial burden of the railways.

Technical Reports

Sponsored Fire Resistance Tests on Structural Elements. D.S.I.R. by H.M. Stationery Office, Price 7s. 6d.—Since 1935 large-scale tests have been made under controlled conditions in this country to measure the fire resistance of full-scale parts of buildings. At first, research was centred on finding how common or traditional materials and forms of construction behaved. The results of these investigations were included in the schedules of local authority bylaws. Subsequently, the Joint Fire Research Organisation had a growing demand from industry for tests on proprietary materials and forms of construction, and in recent years much valuable information relevant to modern building methods has been accumulated.

The Joint Fire Research Organisation has made the results of their sponsored tests available in a comprehensive manner in this report, which consists of the first instalment of data sheets, covering several years testing. Full details are given of the materials and methods used in constructing the test specimens, so that those selected for a particular job may be reproduced as closely as possible in service. The tests do not form a connected series, but many proprietary materials and methods are covered, under the headings of walls (load-bearing and non-load-bearing) ; floors (simply supported and restrained), suspended ceilings, steel and concrete columns, and glazing. Supplementary data sheets will be published at intervals.

Agricultural Machinery Show at Earls Court

No. 1

The Royal Smithfield Show and Agricultural Machinery Exhibition opens at Earls Court, London, on Monday, December 5, and will close on Friday evening, December 9. In this first article we deal mainly with the tractor exhibits. In next week's issue we hope to describe some of the many new implements which will be shown at Earls Court for the first time.

IN the introduction to our description of the agricultural machinery on display at the Smithfield Show exactly 100 years ago we referred to the "annual show of cattle and implements at the Baker Street bazaar" as the "great feature of the Metropolitan week." Whilst it is still a great feature, indeed greater than ever, we must now, with due respect, refer to the exhibition which opens at Earls Court on Monday, December 5, by its new title—the Royal Smithfield Show and Agricultural Machinery Exhibition. It has been claimed that Great Britain has the most highly mechanised farming system in the world, but we feel sure that the very full range of the latest mechanical farming equipment which will be displayed this year will make it abundantly clear to visitors that British engineers and designers have by no means been content to "rest on their laurels."

Although home sales of farm machinery are lower than they were last year, in the ten months from January to October of this year, United Kingdom exports of farm machinery, including tractors, were 22·8 per cent higher than in the corresponding period of 1959, and have been valued at £108,700,000. Of this increase, 33½ per cent has been due to tractors and 13·3 per cent to implements. During the whole of this year, it has been estimated that British tractors and farm machinery to the value of £130 million will be exported.

Following the now familiar pattern of post-war "Smithfield" shows, most of the 6½ acres of floor space at Earls Court will again be taken up by the machinery and implement exhibits. As we go to press we learn that the recent outbreak of foot and mouth disease will prevent the showing of live cattle at this year's show. The carcass competion will, however, still be held.

Among the many tractors which will be on show next week there will be some new models and several others which incorporate improvements.

It was in 1951 that the Ford Motor Company, Ltd., introduced the new Fordson "Major" tractor (THE ENGINEER, November 30, 1951), and six years later this was joined by the Fordson "Dexta" (THE ENGINEER, November 29, 1957). Less than a year later the company introduced the "Power Major" tractor, the diesel-engined version of which gives 51·8 b.h.p. at 1600 r.p.m. At the time of the "Power Major's" introduction plans were already being made to improve its "work output" without increasing the engine power and without impairing its fuel economy factor, and the new tractor illustrated herewith, the Fordson "Super Major," incorporating many improvements, has now been introduced. The engine is the same as that used in the "Power Major" and was described in detail in our issue of September 5, 1958. Both petrol and diesel-engined versions are available of the "Super Major." The hydraulics of the new tractor are fitted with the "Qualitrol" control system, a method of selective depth control by implement draught which allows work to be completed under constantly changing soil conditions and ground contours. There has also been incorporated in the hydraulics system a flow control valve enabling the operator to alter the rate of oil flow to suit variable working conditions. The effect of the valve is a smoothing-out of reaction to the draught signal which can alter considerably due to the varying draught of small or large implements. When the implement is raised out of work the valve is automatically set to give full rate of flow and allow maximum rate of lift; when the implement is lowered again, the flow control valve is returned to the preset position. On either level or undulating land, the operator is therefore able to make the most effective use of the tractor whether using light or heavy draught implements in light or heavy soils. Position control is obtained by the lift arms being set in a predetermined position by cam and follower on the cross shaft; an implement automatically maintained in its relative position to the tractor irrespective of changes in soil resistance.

The "Super Major" is fitted with a differential lock, a device by which the operator can cut out differential motion of the rear axle shafts and so obtain the effect of the combined adhesion of both wheels. A stronger differential assembly has been developed in which the side gears can be locked together by a splined coupling which can be engaged by the operator through a foot-pedal located to the right of the transmission housing.

The new tractor is also fitted with "Duo-Linkage" enabling it to pick up and work implements having pins for either Category 1 or 2 linkage. The implement-ends of the lower links of the tractor are provided with a slot which has been designed so that the Category 2 ball normally fitted can be rotated and withdrawn and replaced with a Category 1 ball. When not in use the ball is held by a spring-loaded retainer.

The tractor is equipped with self-energising double disc brakes controlled by foot pedals which operate independently as steering brakes and which can be locked together for road work.

The Fordson "Dexta" tractor, illustrated on this page, has had the new flow control valve added to its hydraulic system giving it the same improvements outlined in the description of the "Super Major." The "Dexta," which is rated at 30 b.h.p., has also been fitted with an improved gearbox giving a slower first gear, an additional gear in the lower speed range and increased power take-off horsepower. The company is now manufacturing a petrol-engined version of the "Dexta" which is

The Fordson "Dexta" tractor

The Fordson "Super Major" tractor

at present only available for overseas markets. It has a four-cylinder 2188 c.c. engine developing 37 b.h.p. at 2000 r.p.m. and has a compression ratio of 6 : 1. The diesel-engined version of the "Dexta" was fully described in our issue of November 29, 1957.

Allis-Chalmers, Great Britain, Ltd., has introduced a new four-wheeled, general-purpose agricultural tractor, the model ED-40. The engine is a Standard-Triumph four-cylinder diesel, 4in bore by 3 $\frac{8}{16}$in stroke, with a capacity of 137·89 cubic inches ; at 2000 r.p.m. the engine will give 37 b.h.p. The transmission provides eight forward and two reverse speeds—from 0·92 m.p.h. to 15 m.p.h. Power take-off is fitted, having a rotation speed of 547 r.p.m. at governed engine speed of 1700 r.p.m. and 643 r.p.m. at governed engine speed of 2000 r.p.m. Height from the ground of the power take-off is 23in. An auxiliary hand clutch, which is available as optional equipment, provides "live" power take-off.

A hydraulic pump mounted on the engine takes its supply from an independent hydraulic oil reservoir and delivers it under pressure to the hydraulic lift. An integral part of the hydraulics of the new tractor is a built-in selective weight transfer system. A simple finger-tip control situated on the instrument panel brings the system into operation and transfers implement weight to the rear wheels of the tractor without affecting the working depth of the implement. An adjustable depth stop is provided, which, when set, maintains the implement at the correct working depth regardless of land conditions.

The tractor has three-point linkage accommodating both Category 1 and 2 mounted implements. Standard tyre sizes are 400 × 19 on the front wheels and 10 × 28 on the rear wheels. The front axle adjustment is from 48in to 70in, and the rear wheels are adjustable from 48in to 72in in 4in increments. The weight of the tractor, fully equipped, is 3920 lb, its overall length 114in, overall width 59in, and clearance for the use of mid-mounted implements 26in.

(*To be continued*)

Roundabouts and Traffic Signals

THE Traffic Engineering Study Group of the Institution of Civil Engineers met on November 17 to discuss Roundabouts and Traffic Signals as alternatives for the treatment of busy intersections. Separate papers by Dr. T. E. H. Williams, Senior Lecturer in Highway and Traffic Engineering, Durham University, and Mr. H. C. Smith, assistant county engineer and surveyor, Middlesex, formed a starting point for the discussion. The Chair was taken by Mr. W. F. Adams, Ministry of Transport.

The basis upon which the discussion proceeded was aptly defined by the speaker who said, "there is a place for roundabouts, and a place for traffic lights." (The colloquialism "traffic lights," meaning an automatic traffic signal controlled intersection, was used throughout.) However, before the meeting settled down on that basis, one speaker broadened the discussion momentarily with a contribution hingeing on a visit he had paid to the Highways Department of the State of California, where he had asked the innocent question, "And what do you think of roundabouts ?" only to receive the answer, "If you will tell us what a roundabout is we will tell you what we think of it !" Having described one he was simply told there was no place for the device in their scheme of things. Enlarging on this to the meeting, he pointed out that the Americans have long had a principle ; through adhering to that principle, it must be admitted, they have achieved great success in traffic control ; it is the principle of non-interference of one traffic lane with another. Roundabouts are the antithesis of that principle, particularly when located on main, major highways. Illustrating his theme with slides of roundabouts in this country, in the construction of which he had himself played a part thirty years ago, he finally reminded the meeting that this is 1960. However, this contribution went unpursued, the fixed intent being to discuss roundabouts and traffic lights, upon which there was plenty to be said : the proceedings lasted for 2½ hours.

Economics were accepted as the criterion for choosing between the two systems. To open up this aspect of the subject Mr. Smith had tabulated, in detail, the average annual cost of twenty-four truly comparable crossroads in Middlesex, half with roundabouts and half with traffic lights, carefully selected from the county's fifty-nine roundabouts and 254 traffic lights. He assessed their annual cost under three headings : direct financial burden, delays, and accidents. Under the first heading his average figure for the roundabouts was £1000 per annum (being 5 per cent interest on capital outlay £20,000), and for traffic lights £235 per annum (comprising maintenance £110 per annum and interest on a capital outlay of £2500) ; no questions arose over those figures, but a number arose over delays and accidents, in his assessment of which Mr. Smith showed the advantage to lie preponderantly with his roundabouts.

He had costed the delays at traffic lights at 7s. 6d. per vehicle-hour, whereas at roundabouts the only factor he had taken into account was the extra distance travelled by the vehicles, at 4·2d. per vehicle-mile. The view was expressed—and probably accepted by the majority of those present—that the reduction in speed of vehicles at roundabouts, say from 30 to 15 m.p.h., constituted a delay that should be costed. Country-wide average figures were quoted showing a basic delay of eight seconds at roundabouts plus a further seven seconds for speed reduction, making fifteen seconds in all compared with nineteen seconds at traffic lights : the advantage of roundabouts in this respect could be no more than marginal.

A crossroads' accident rate falls by 40 to 45 per cent when traffic lights are installed ; a roundabout could be expected to effect a 60 per cent reduction, roundabouts being some 30 per cent safer than traffic lights. Those figures were given general acceptance ; but it transpired that Mr. Smith's twenty-four crossroads had an abnormally high accident rate, which amplified the economic advantage of his roundabouts. The yearly national averages were stated to be one-and-a-half accidents per roundabout, and two to two-and-a-half per traffic lights ; the figures for the whole of Middlesex were given as 3·4 and 5·18 respectively, but the selected roundabouts averaged four accidents a year, and the selected traffic lights seven. The difference of three raised the annual cost of the traffic lights by £1620 (at the Road Research Laboratory 1957 figure of £540 per accident), and provided a further reason for discounting the wide economic advantage of roundabouts over traffic lights tabled by Mr. Smith on his particular experience. He welcomed this levelling-up process, disclaiming any strong personal preferences in the matter : every site requires individual treatment based on thorough examination of all the factors.

The accident figures so far quoted in this report relate only to personal injury accidents. The lack of statistics on damage-only accidents (which are not reported to the police) was regretted by many of the Group : it was conjectured—and disputed—that the proportion of damage-only accidents to personal injury accidents is higher at roundabouts than at traffic lights. There was a similar divergence of opinion over the popularity or unpopularity of roundabouts ; do drivers seek out alternative routes to avoid them, thereby possibly causing accidents elsewhere ? Drivers do so in Newcastle, it was alleged, but not in London.

The superimposition of traffic lights on roundabouts for use at peak hours was, on the whole, welcomed. The meeting was assured that it increases capacity by 8 to 10 per cent, and minimises locking, which is otherwise prevalent when the traffic exceeds 80 per cent of the roundabout's capacity. The long history of traffic lights at roundabouts was duly traced, following the custom of the Group whenever anything arises that might be thought new. On the detailed design of urban roundabouts one speaker showed, by means of a slide, the

saving in area (and accordingly in land purchase) resulting from the use of a square or rectilinear central island, with suitably rounded corners ; other speakers confirmed the soundness of the design, for straight sides facilitate weaving. However, it transpired that sound design could do little to reduce locking or other troubles at roundabou ts attributable to bad driving such as " cutting " ; giving priority to traffic on the right would too often result in the dominance of one stream ; anything in the way of a priority line painted on the carriageway would go unheeded by drivers preoccupied with other traffic to right and to left of them ; roundabout capacity is strictly limited by the law that a pair of weaving lanes have at the most the straight capacity of a single lane, and very much less if the weaving section is short ; there did not seem to be much to be done for roundabouts.

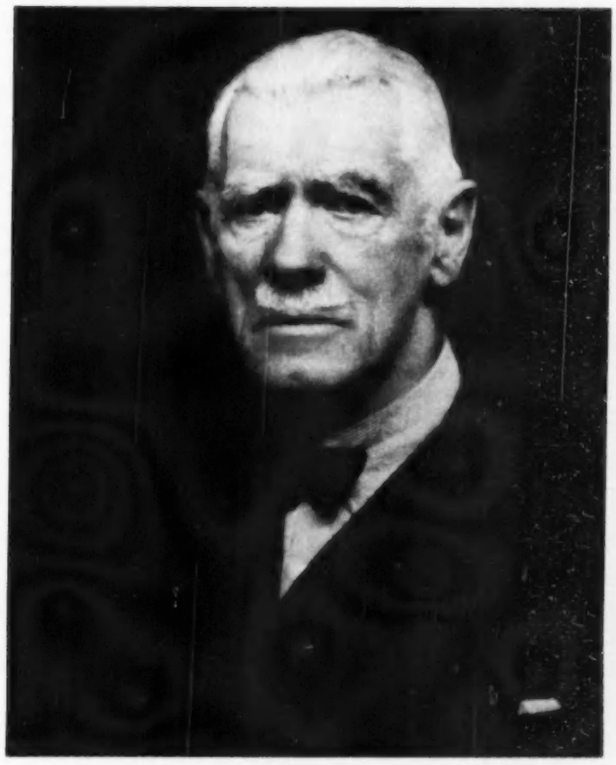
On the other hand traffic lights can be expected to improve somewhat through modernisation. Efficient, reliable speed-timing mechanisms are now available, and more is known about the locating of detector pads farther out to suit modern traffic. Central, overhead traffic lights had had only a brief career terminated by the requirement for a primary and a secondary indication to be available to each driver, but it was hinted that they might be reintroduced for certain sites with multi-lane approaches. Doubts were expressed, however, on the scope for linking, co-ordinating and " master controlling " signals in non-geometric British cities.

On the subject of pedestrian crossings there was an illustrated description of the scramble system, under which the pedestrians own the entire crossing during an all-red period ; it was stated to be popular with all immediately concerned, though less popular back along the line of traffic in that it adds to the delays : in one instance it had reduced the through journey speed from 6 to 4 m.p.h. ; no speaker advocated it positively. The view was expressed that roundabouts lend themselves to the construction of pedestrian subways.

Beating in mind the steady increase in traffic several speakers touched on the problems met in developing existing intersections. At traffic lights the approach roaos could sometimes be widened to provide an additional traffic lane, or two, with proportional increase in capacity. But roundabouts were held to be inelastic : their development could be achieved only through grade separation, involving complete reconstruction. In this connection it was remarked that already, in urban areas, a roundabout might cost as much as £1,250,000 and that when so large an expenditure was contemplated the authority concerned would be well advised to face the not disproportionate further cost of grade separation.

OBITUARY

Sir John Edward Thornycroft, K.B.E.



Sir John Edward Thornycroft, K.B.E.

SHIPBUILDERS and marine engineers both in this country and abroad will have learned with great regret of the death of Sir John Edward Thornycroft, which occurred at his home at Steyne, Bembridge, Isle of Wight, on Monday, November 21. Sir John, who was born at Chiswick on September 5, 1872, was in his eighty-ninth year, and was the elder son of Sir John I. Thornycroft, who founded a shipyard at Church Wharf, Chiswick, in 1864. He obtained his early education at St. Paul's School between 1885 and 1889 and then completed a three years' engineering course at the City and Guilds Technical College before gaining practical experience while serving as a mechanic in all the engineering departments and also in the shipyard. With this background of theoretical and practical training he took a more active role in the operation of the yard, being appointed assistant manager in 1895, and during the next few years was concerned with the supervision of the construction and trials of many torpedo-boats and other high-speed craft upon the building of which the Chiswick yard was largely engaged. Coincident with the conversion of the Thornycroft family business into a public company John Edward became the managing director. Under him the firm continued to be associated with the building and development of torpedo-boat destroyers, a development which can be exemplified by linking the 28-knot " Daring " of 1894 with the " Daring " class destroyer H.M.S. " Duchess," of 2800 tons standard displacement, built at Southampton in 1952.

At Chiswick, interests were not concerned only with shipbuilding and marine engineering but were also directed to road transport problems. Experimental work in this field resulted in the production of the Thornycroft steam wagon and an oil-engine tractor from which evolved the present road transport business now located at the Basingstoke works. The steady increase in the size of destroyers and the building limits imposed by the Chiswick site put a term upon the ability of the yard to construct such craft, and in 1904 a start was made with the transference of the firm's shipbuilding activities to Woolston, Southampton. Here the firm, under its managing director, continued to play a leading role in the evolution of the torpedo-boat destroyer, and during the first world war was closely concerned with the design and building of the first coastal motor torpedo-boats and of many other items, including depth-charge throwers. It was in recognition of Thornycroft's services during the war that he was awarded the K.B.E. in 1918.

During the inter-war years Sir John remained in control of both the shipbuilding, marine engineering and road transport activities of the company and continued to do so throughout the critical period from 1939 to 1945. At this time his wide experience was of considerable value and, despite his advanced years, he remained receptive of new ideas and retained his powers of application and decision. Nevertheless Sir John found it necessary to delegate some of his duties and in 1943 his elder son, John W. Thornycroft, was appointed as one of three joint managing directors, and in 1958 he became deputy chairman. In July of this year Sir John, who had been chairman and governing director since 1943, resigned these appointments and was made President of the company, while some two months later his son assumed the duties of chairman and managing director.

Sir John, as fitted an eminent shipbuilder and engineer, was closely associated with various technical societies, becoming a member of the Royal Institution of Naval Architects in 1908, a member of council in 1912, a vice-president in 1928, and being elected an honorary vice-president in 1943. He read a number of papers before the Institution, including " Gas Engines for Ship Propulsion," " Modern Torpedo-Boats and Destroyers," and " Coastal Motor Boats " in 1923 in collaboration with Lieutenant Bremner. He was elected a member of the Institution of Civil Engineers in 1899 and was President in 1943, and also became in 1919 a member of the Institution of Mechanical Engineers, of which institution he was President in 1937.

Ross Motorway

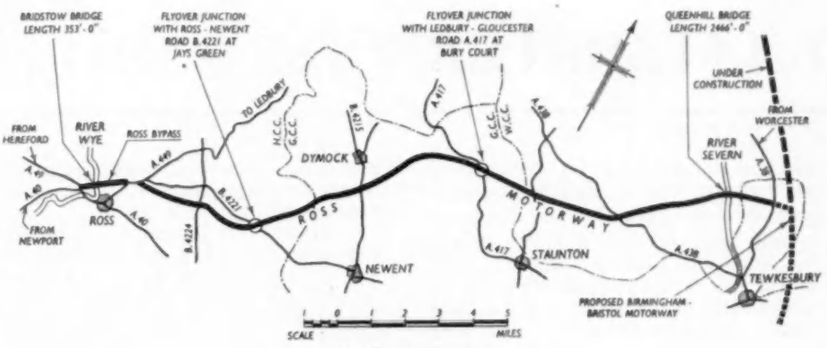
Last Monday, the Minister of Transport, Mr. Marples, opened the Ross Motorway, which is 21 miles in length and is described by the Ministry as "a vital link between the Midlands and South Wales." The new motorway is known as the M.50, and is noteworthy for some interesting bridge construction, and for the beauty of the countryside through which it passes. A typical length is shown in the heading illustration.

THE new Ross motorway, together with the Ross by-pass which is 1½ miles long and was opened in September, give a length of 22½ miles of dual two-lane carriageways which will eventually form a spur leading to South Wales from the Bristol–Birmingham motorway (M.5): the Ross by-pass is, however, not restricted to motor vehicles. From the western end of the Ross by-pass at Wilton in Herefordshire, the existing main roads—all of which are to be reconstructed—lead on to Swansea via the Heads of the Valleys Road and to Newport and Cardiff. The major bridge of the motorway, Queenhill bridge over the Severn, is not yet complete, but one carriageway of the bridge is now in use, and the second is due for completion in the Spring. With the exception of the M.1 and its spurs, the length of M.50 which will be in full use when the Queenhill bridge is completed, is thus the longest stretch of motorway in the country. Shorter lengths—of the order of 10 miles—are in use at the Maidstone, Preston and Lancaster by-passes, and the Stretford–Eccles by-pass, the former in Kent and the three others in Lancashire.

The Ross motorway scheme passes through three counties, as can be seen from the sketch plan. The western section of the scheme in Herefordshire was constructed to the designs of the county surveyor of Herefordshire, Mr. D. H. Banks, M.I.C.E., the bridges in this section being entrusted to consultants, Messrs. Scott and Wilson, Kirkpatrick and Partners. The main contractor for this section of the work, covering about 7 miles of road including the Ross by-pass and the Bridstow bridge, was Tarmac Civil Engineering, Ltd. The central length of road was the responsibility of the county surveyor of Gloucestershire, Mr. R. A. Downs, A.M.I.C.E., with the eleven bridges in this section were designed by consulting engineers, namely, Messrs. W. S. Atkins and Partners. The main contractor for this section was R. M. Douglas (Contractors), Ltd. There were, in fact, four main contracts, the last-named firm being the contractor for two of them. The fourth main contract, mainly in Worcestershire, was carried out by A. E. Farr, Ltd. Mr. W. R. Thomson, M.I.C.E., county surveyor of Worcestershire, was responsible for the roadworks in his county. The Queenhill bridge and its approaches, which have a length of 2500ft, and which cost over £1,250,000, were the responsibility of Sir Alexander Gibb and Partners. The main contractor for contract 4, A. E. Farr, Ltd., built the bridge, except for the steelwork of the main spans for which Head Wrightson, Ltd., was the contractor. It should be added that the three county surveyors acted as agent authorities of the Minister of Transport, and overall responsibility for the

Right: Two-level interchange at Jay's Green, showing the Ross-Newent road (B.4221) crossing the motorway

Below: The beam and slab bridge with two 41ft spans carrying B.4221 over the motorway. The abutments are faced with red sandstone, quarried locally, which is typical of many of the bridges.



The Ross motorway

engineering practicability of the scheme rested with Mr. J. F. A. Baker, M.I.C.E., chief engineer of the Ministry. The Ministry was directly responsible for much administrative detail of the scheme, including land acquisition. The overall cost of the scheme was approximately £6,000,000. The various photographs reproduced with this article all relate to the section of the scheme in Herefordshire.

Since the scheme is the second-largest road scheme so far (excluding, of course, certain major bridges and tunnels at present under construction) it has already been the subject of various articles in this journal, principally, "Motorway Design and Construction in Worcestershire," by Mr. W. R. Thomson (THE ENGINEER, December 26, 1958), and "Caisson Sinking at Queenhill Bridge" (THE ENGINEER, October 23, 1959). An interesting correspondence discussing the relative merits of a special "launcher" as against lorry-mounted cranes for placing bridge beams used experience on the Ross scheme as a background (THE ENGINEER, August 5 last) and progress pictures were published last January.

THE ROSS MOTORWAY

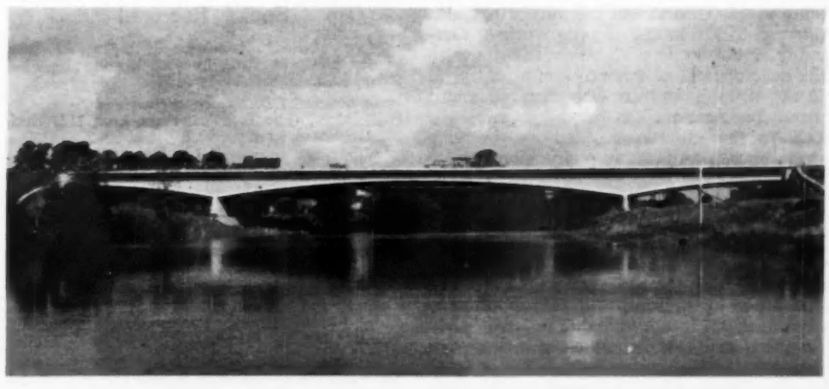
Some principal figures for the motorway are given in the accompanying Table. It has a dual two-lane layout, as we have already noted, with the standard Ministry of Transport carriageway widths and marginal strips. The formation width is 88ft, indicating some economy in design. Major constructional features of the motorway include the crossings of the Wye and Severn flood plains, each involving a major bridge with extensive approach embankments. The Bridstow bridge over the Wye is a graceful prestressed concrete structure as shown by the illustration herewith. The embankment on which it is centred is 2000ft long, and is pierced by seven flood-relief arches. The maximum height of this embankment is 33ft.

Data for the Ross Motorway

Construction started	March, 1958
Opened to traffic	November, 1960
Length	21 miles
Design speed	70 m.p.h.
Maximum curvature	2046ft radius
Maximum gradient	1 in 25
Visibility	800ft
Formation width	88ft
Lay-out	Dual 24ft carriageways with four marginal strips 12in wide
Central reservation	13ft
Hard shoulders	8ft wide in 11ft 6in verges
Surface	Hot rolled asphalt
Cost (approximate)	£6,000,000
Anticipated daily traffic flow in 1961	10,800 passenger-car units
Traffic capacity of a dual two-lane road	35,000 passenger-car units per day
Total quantity of excavation required	2,250,000 cubic yards

The Queenhill bridge is of dual construction, each carriageway being on what is virtually a separate bridge carried on a single line of reinforced concrete columns, with twin anchor piers constructed as prominent features at each end of the main steel structure. The bridge is built to a curve of 8000ft radius, and has twenty-four approach spans, each of about 82ft, in reinforced concrete. The steel bridge over the Severn is a three-span continuous girder of approximately 130ft plus 24ft plus 130ft-lengths, giving 44ft clearance over the river.

The appearance of the motorway is stressed as an important consideration in design; landscape treatment includes planting proposals at a few selected points, and "the alignment and profile of the motorway have been sympathetically related to the hills and valleys of the surrounding countryside," the Ministry states. There are two intermediate points of access to, and egress from, the motorway, as shown on the plan, and typified by the illustration on page 932.



Bridstow bridge has a 203ft span in the centre and two approach spans each 75ft long

CARRIAGEWAYS

Construction of the carriageways in the Herefordshire section consisted of a sub-base of crushed stone of 3in maximum size varying in thickness from zero to 10in depending on the formation, which was either a rock cut or a fill. This was followed by two 4in layers of lean concrete, containing 3 per cent of cement, laid by machine. The top layer was sealed by a bitumen emulsion spray. Then came the "black top," viz. a 3in base course of 1½in nominal size bitumen macadam and finally a 1½in running surface of hot rolled asphalt. In Gloucestershire construction was similar, with gravel and stone foundations and a coated stone surfacing. Carriageway specifications for the Worcestershire section of the road were discussed in some detail in the paper by Mr. Thomson referred to above. All that need be repeated here is that five forms of construction were included in the tender documents for contracts 3 and 4 of the motorway with the intention of adopting the cheapest. This comprised on contract 4, 4in to 9in of quarry waste (as sub-base according to C.B.R. requirements), 8in of 2in single-sized crushed stone, in two layers, 3in of bituminous macadam base course and ¾in temporary running surface of fine cold asphalt. On contract No. 3, the bituminous macadam base course was 4in thick, and was underlain by 6in of soil cement (10 per cent cement content) foundation, and a further soil cement and granular fill sub-base, according to the C.B.R. range.

Poly-Propylene in Production

TWENTY-FIVE years ago Imperial Chemical Industries, Ltd., discovered means of polymerising ethylene at high pressure and temperature to yield a range of crystalline thermo-plastics of outstanding toughness and chemical resistance, and with excellent electrical properties. This led to the production of "Alkathene," which is made by I.C.I. in Great Britain at a rate of over 100,000 tons a year. With the polymerisation of ethylene achieved, attention was turned to higher alpha-olefines, but until six or seven years ago attempts to produce useful solid polymers from the next member of the olefine family—propylene—had proved unsuccessful. By 1954 the work of Professors Ziegler and Natta had made possible the production of long-chain polymers of propylene in which the molecules are arranged in a regular way. From this work I.C.I. has developed "Propathene."

The main raw material for propathene—propylene—is available from the oil-cracking equipment already existing at the I.C.I. Wilton works. This raw material is polymerised under low pressures and at normal temperatures, using Ziegler-type catalysts. New plant installed at Wilton for the manufacture of propathene is now in full production.

Propathene has numerous interesting characteristics. It is the lightest in weight of all commercially available plastics, having a density of only 0·90 gramme per cubic centimetre. It melts at about 165 deg. Cent., and can therefore be used for a number of applications where temperatures above the boiling point of water are encountered. It also possesses a high degree of rigidity, greater than that of the stiffest commercially available polythene at room temperature, together with a retention of useful strength up to 140 deg.—150 deg. Cent. Propathene also retains adequate strength for many purposes at sub-zero temperatures. It has a very low moisture absorption, and possesses high resistance to attack by organic and inorganic liquids. Of particular interest is its resistance to oils, fats and greases. The electrical properties of propathene are comparable with those of other hydrocarbon plastics. Propathene is exceptionally easy to mould and extrude, and gives articles of good strength and excellent finish. All normal plastics fabrication methods—vacuum forming, machining, drilling and tapping—can be used.

[Reply Card No. E9331]

LETTERS AND LITERATURE

Letters to the Editor

THOUSANDS OF MILLIONS OF POUNDS TO BE SAVED ?

SIR,—I was very interested to read Brigadier Lloyd's reply, in your issue of November 18, to my suggestion that railways are potentially much less vulnerable to bad weather conditions than highways, even when the latter are "railway conversions." I should particularly be interested to know where Brigadier Lloyd got his figure of fifteen days out of 365 ; surely this depends on the interpretation one puts on the word "seriously."

While Brigadier Lloyd suggests that a number of steps can be taken to alleviate the effect of bad weather on motorway style transport, he cannot surely envisage that they can effect a complete cure. After all it is quite commonplace for traffic to be brought down to walking pace by fog, even in areas where "installed lighting" is already provided, and an "emergency speed limit" of 5 or 10 m.p.h. which would be required to deal with bad fog is certainly little better than a complete standstill. "Electronic Guidance" can hardly be regarded as "commonplace" as yet, particularly if it must be applied to vehicles by the million.

What is needed is a transport system on which traffic can be kept moving in bad weather at 60 m.p.h., and I am still convinced that this can only be achieved by a railway.

I. G. MOORE

Chippenham,
Wilts.,
November 25, 1960.

SIR,—May I point out to Mr. Roy G. De Bray that there are over 12,000 miles of railway track in Britain which could accommodate a 24ft wide roadway with ease and of these there are 1500 miles over 60ft wide and 450 miles over 40ft wide. In addition to this there are well over 7000 miles of single track, most of which was laid out with duplication in mind.

These 24ft wide roads would be three times the width of buses and trucks and in the case of mass produced cars such as the Ford "Anglia," which is 4ft 9½in wide, the road would be five times wider than the car and this would still apply in tunnels.

When we also take into account the facts that these excellent routes seldom have gradients exceeding 1 in 100 and they run right into the city centres where there are vast stations and goods yards which could be used as car parks as well as accommodating bus stations, &c., I think that railway conversion presents a wonderful future.

I am well aware that a small amount of construction work would be needed at junctions and for the elimination of crossings on the level as the volume of traffic increased, but this would be an easy task with to-day's modern machinery. It should be remembered that during the 1840s it was quite common to open 500 to 600 miles of railway a year, and in 1848 they opened 1182 miles, although the navvies that built them only had picks, shovels and wheelbarrows to help them.

With this in mind I think that conversion could easily be completed in ten years and for a start I would suggest that such lines as the Hull and Barnsley and the Great Central from London–Sheffield should be converted as well as other examples of urban and branch line railways.

This would give us practical experience in the construction and operation of the new type of motor-roads, although we can already learn a great deal from the Pennsylvania Turnpike in the U.S.A. which for over 30 miles of its length uses the track of the old south Pennsylvania Railroad. This motor-road often carries over 2000 vehicles per hour through its seven tunnels, which total 6½ miles in length and only have a single 24ft wide roadway running through them.

A. I. WATKINSON

Harrogate,
November 22, 1960.

Book Reviews

Magnesium and Its Alloys. By C. SHELDON ROBERTS. John Wiley and Sons, Inc., New York. Chapman and Hall, Ltd., 37, Essex Street, London, W.C.2. Price 72s.

MAGNESIUM is now cast, forged and machined in routine peacetime engineering as a structural material ; it is also widely used as a versatile chemical. Some new, original scientific and engineering study of magnesium and its alloys appears in the technical literature of the world every few days throughout the year. These numerous publications approach the subject in different ways ; specialised, popularised, or designed to aid workshop practices.

This new volume, of 230 octavo pages, is a very concise reference book of surprisingly broad scope, presenting the latest theories and practices concerning magnesium metal and its alloys. The technological details in its last four chapters stem mainly from the great resources of the Dow Chemical Company in the U.S.A., but the author has also referred to the intensive early work in Germany, the later important contributions to the development of modern casting alloys in Great Britain, and to Canadian advanced metal purification. It was, however, the U.S.A. that first succeeded in bringing magnesium products to really high-volume production.

Dividing his subject into nine chapters the author first deals with atomic, structural, thermal, electrical and magnetic properties of magnesium. Then he introduces a well-informed chapter on alloy theory and properties by pointing out that pure magnesium metal is not valuable in many technological applications. Each of his chapters is concluded with an up-to-date list of references. These point to literary work above the powers of a single author : it is good therefore to see in his acknowledgment that the author thanks more than a dozen of his colleagues and other helpers.

Metallurgists will treasure the forty diagrams of the binary and ternary magnesium alloy systems given in the third chapter. Engineers will find the next four chapters much more helpful to them because these deal with the deformation of magnesium, time-temperature-dependent phenomena, and the technologies of casting alloys and wrought alloys. Chemists will find the eighth chapter, which deals with anodic behaviour, corrosion, protective anodes, the magnesium dry cell, and important chemical applications, an up-to-date and concise summary.

The final chapter on the extraction and refining of magnesium considers raw material sources. Here one should note that the extractive metallurgy of magnesium is intriguing because of the diversity of processes which have competed at different times in the history of the metal, and in so many parts of the world. The author discusses only processes that have been used recently or are still being used with commercial success, such as electrolytic reduction, and the direct reduction processes. The two lowest cost producers, in U.S.A. and Norway, both use electrolytic processes under conditions of great natural advantage. However, the Canadian users of the direct reduction process are putting in such a research effort that one of the direct processes may eventually undercut the electrolytic process costs.

World production of magnesium dropped from the wartime peak of 225,000 tons during 1943, but recently the development of large-volume non-military markets in the U.S.A. has caused a recovery of consumption ; this suggests a production of 1,000,000 tons in 1970, were present trends followed. The author has previously published papers in the fields of solid state precipitation, plastic deformation, and semiconductor behaviour. He is now Head of the Materials Section, Fairchild Semi-Conductor Corporation, and was formerly associated with the Shockly Semi-Conductor Laboratory and the Dow Chemical Company. In 1954 he won the Alfred Noble prize of the combined engineering societies. His book will be valued by many as a credit to him and to its publishers.

Books Received

More Unusual Railways. By John R. Day. Frederick Muller, Ltd., Ludgate House, 110, Fleet Street, London, E.C.4. Price 21s.

An Illustrated Dictionary of Plumbing Terms. By Evan Berry. The Technical Press, Ltd., 112, Westbourne Grove, London, W.2. Price 15s.

The Testing of Electrical Machines. By L. H. A. Carr. Macdonald and Company (Publishers) Ltd., 16, Maddox Street, London, W.1. Price 50s.

Statistical Processes and Reliability Engineering. By Dimitris N. Chorafas. D. Van Nostrand Company, Ltd., 358, Kensington High Street, London, W. 14. Price 96s.

Electronic Equipment Reliability. By G. W. A. Dummer and N. Griffin. Sir Isaac Pitman and Sons, Ltd., Pitman House, Parker Street, Kingsway. London, W.C.2. Price 45s

Reinforced Concrete Piling and Piled Structures. By F. E. Wentworth-Sheilds, W. S. Gray, H. W. Evans. Concrete Publications, Ltd., 14, Dartmouth Street, London, S.W.1. Price 18s.

MAINLY METALLURGY

by T. Henry Turner, M.I.Mech.E. M.I.Loco.E. A.R.Ae.S. F.I.M.

Corrosiveness of Indoor Atmospheres

Ten years ago very little was known about the corrosiveness of various indoor atmospheres. The Atmospheric Corrosion Sub-Committee was set up by the Iron and Steel Institute and, meeting for the first time in August, 1944, naturally turned its attention primarily to the extensive corrosion of steel exposed to the weather. It had its test pieces of steel fixed to racks for exposure under controlled conditions in many parts of this country and abroad. In this way much quantitative information was made available during the fifteen years in which the present writer served as its chairman.

However, at its eighteenth meeting, in June, 1950, Dr. R. S. Thornhill, who had studied corrosion in Cambridge University and then served in the research department of Imperial Chemical Industries, Ltd., said that it appeared to him that most of our work till then had been on external structures and that he would like to see some work carried out on the corrosion of internal structures, as he considered a grave problem existed due to condensation, &c. From his own experience he knew that internal steelwork rusted just as badly as external structures. He was asked to give further details and at the following meeting he reported that factories where the possibility of the corrosion of steelwork could be serious included :—pickling and galvanising shops, tanneries, ceulllose, cotton and paper manufacturing shops, laundries, &c. Members agreed that Dr. Thornhill had made out a case for testing the corrosivity of different steels in buildings and he was appointed convener of a panel to study, together with Dr. J. C. Hudson and Mr. R. St. J. Preston, corrosion tests on steel used for indoor structures. In April, 1951, he submitted their proposals for exposing test specimens 4in by 3in by 20G. mild steel, copper-chromium steel (Cor-Ten), electrolytic zinc and high-purity aluminium. The committee approved this series of tests and the work was put in hand, the specimens being fixed vertically and initially exposed for one year.

The results of these experiments are now made public for the first time in a paper by Mr. J. F. Stanners, B.Sc., who succeeded Dr. Hudson in September last as Head of Corrosion Research, in the Chemistry Department of the British Iron and Steel Research Association. (See the November issue of the *Journal of Applied Chemistry*, published by the Society of Chemical Industry.

Sets of the small test specimens were exposed in no less than forty-five different atmospheres, principally indoors in factories, and the results observed provide a measure of the relative corrosiveness of the atmospheres in such places. The test specimens actually used were of bare low-alloy steel and mild steel, and mild steel sprayed with aluminium or with zinc. The Atmospheric Corrosion Sub-Committee and the author thank very many research associations, firms and householders for providing the essential exposure facilities, and especially thank Metallisation, Ltd., for the supply of coated specimens, and the Pyrene Company, Ltd., for degreasing facilities.

So far as is known this was the first time that such extensive, unbiased, and scientifically conducted tests on indoor corrosion of steel have been conducted ; no such quantitative data having been previously available to engineers and architects the following conclusions should be worthy of note :

The most corrosive indoor atmospheres investigated were those where large quantities of acids were used, and those of a bleach-house, a plating shop and a glue extraction plant. Several were more corrosive than the atmosphere outdoors at Sheffield, particularly towards the metal coatings.

Although aluminium protected the steel better than did zinc when freely exposed outdoors in industrial atmospheres, a zinc coating was much superior to an aluminium one in many of the indoor atmospheres.

High humidity was associated with rapid corrosion rates, but corrosion was slow in relatively clean but humid atmospheres, such as were found in a laundry, domestic kitchens and bath rooms.

Only in a few instances are the atmospheres inside factories more corrosive than outdoor industrial atmospheres towards bare steel. Protective metal coatings, however, break down more rapidly in many indoor environments than they do in outdoor atmospheres that, so far as bare steel is concerned, are just as corrosive.

Under indoor conditions, zinc is to be preferred to aluminium as a protective coating and in many instances there is no doubt that corrosion troubles with structural steelwork in factories would be much reduced by the use of zinc coatings.

During the course of these experiments it has been noticed that high corrosion rates are frequently associated with high humidity and with inadequate ventilation of acid fumes. Any steps that can be taken to keep buildings dry and to reduce the concentration of acid fumes, for example by enclosing tanks or by installing more efficient fume extraction systems, will reduce the corrosion and protection troubles so often experienced. Indeed, for some purposes, the expense of an air-conditioning scheme may be warranted.

First International Congress on Metallic Corrosion : London, 1961

The first printed provisional programme, and list of officers and committees, has just been issued by the organisers of the First International Congress on Metallic Corrosion. This is to be held between April 10 and 15, 1961, in the Imperial College of Science and Technology, South Kensington, London, S.W.7. Membership is open to all interested persons and the fee of £5 is payable to the First International Congress on Metallic Corrosion, 14, Belgrave Square, London, S.W.1. Each member may introduce one lady guest, for whom no registration fee will be charged. Preprints of papers will be sent at a later date to members who have paid the membership fee of £5. Proceedings of all sessions, including all scientific papers presented, will be published after the Congress by Butterworths, 88, Kingsway, London, W.C.2.

It is now a year since papers were invited and nearly 100 have been approved by the Scientific Committee of twenty-three well-known corrosionists. They have been teamed together under the chairmanship of Leslie Kenworthy, who is serving for the second year as chairman of the Corrosion Group of the Society of Chemical Industry. The brunt of this preparatory work has fallen on H. S. Campbell, of the British Non-Ferrous Metals Research Association, who serves as the hon. secretary of the Scientific Committee. The papers accepted for this Congress on Metallic Corrosion have been grouped under the following headings, thus :

" Inhibitors " ; " Fundamental Studies " ; " Cathodic and Electrolytic Protection " ; " Metallic Coatings " ; " Practical Experience " ; " Boiler Corrosion " ; " Corrosion in Atomic Energy " ; " Intergranular and Stress Corrosion " ; " Experimental Methods and Laboratory " ; " Corrosion Testing " ; " Atmospheric Corrosion " ; " High Temperature Oxidation " ; " Corrosion Fatigue " ; " Underground Corrosion " ; and " Paints." Arrangements are being made for a number of works visits and social events.

" The Metallurgy of Beryllium " International Conference, 1961

The Nuclear Energy Committee of the Institute of Metals is organising an International Conference, on the metallurgy of beryllium, to be held in London on October 16, 17 and 18, 1961. It plans to make available and to discuss much hitherto unpublished, original work on beryllium. The whole of the field of the metallurgy of beryllium will be covered ; fabrication, physical properties, mechanical properties, metal physics and so on with the sole exception of the processes by which the metal is extracted from its ores.

Offers of original papers for this important conference are now invited by the organising committee, which asks that prospective authors will send them clear titles and synopses of their papers before the end of this year. Final manuscripts, in duplicate, should reach them before the end of March, 1961. Correspondence regarding this International Conference should be addressed to the Secretary, the Institute of Metals, 17, Belgrave Square, London, S.W.1, and prospective authors should advise him quickly of the topics on which they intend to offer papers. It is intended to issue the papers in preprint form before the conference and thereafter to publish them in bound form, together with reports of the discussions.

Appropriate reference to beryllium extraction and uses will be found on pages 820 and 821 of THE ENGINEER for December 18, 1959 ; attention was then drawn to the fact that Imperial Chemical Industries, Ltd., had spent some £10,000,000 on the development of " new metals " production. The proposed conference thus appears to be both timely and important.

Sizewell Nuclear Power Station

A 580MW nuclear power station is to be built at Sizewell, Suffolk, for the C.E.G.B. by the English Electric, Babcock and Wilcox, Taylor Woodrow Atomic Power Group. To limit the physical size and capital costs the two graphite-moderated gas-cooled reactors and the eight boilers will be housed in a single building together with the common pile cap and decontamination services. The reactor pressure vessels, like those at the Hinkley Point nuclear power station, will be spherical, but the plate thickness will be increased to more than 4in (compared with 3in) and the internal diameter will be 63ft 6in compared with 67ft. There will be corresponding advances in gas pressure and temperature and fuel heat rating and the electrical output will be generated by two 325MW turbo-alternators. The contract is worth £55,000,000 and the two reactors are due to come into service in 1965 and 1966.

A NUCLEAR power station of 580MW net output is to be built at Sizewell, Suffolk, for the Central Electricty Generating Board by the English Electric, Babcock and Wilcox, Taylor Woodrow Atomic Power Group. The value of the contract will be about £55,000,000 and on this basis the capital cost would be of the order of £95 per kilowatt sent out.

It will be sited on the Suffolk coast, a few miles north of Aldeburgh and about midway between Ipswich and Lowestoft. The site occupies 240 acres of land which is of little agricultural value and is sufficient in area to allow for further development for power generation in the future. It is well located to help in supplying the base load associated with the rapidly growing demand for electricity in the south-east of England. The site is close to deep water for the condensing requirements of the station. The top soil is mainly fine to medium sand, with the water table 29ft below finished ground level. Good load bearing characteristics are provided by the sub-strata which are also of sand.

A new road from Leiston gives access to the site, which is bounded by woods to the south and west and is open to, but separated from, the North Sea by a low line of sandhills. Special care will be taken to safeguard local amenities and the views along the beach and sand-hills will be preserved. There has been full consultation, throughout the planning stages, with the Suffolk County Council and the Urban District Council. It may be recalled that the C.E.G.B. applied to the Minister of Power in January, 1959, for consent to build the Sizewell station and that this consent was given in February, 1960, without the need for a public inquiry. Work on site is expected to begin in April, 1961, and the two reactors are scheduled to be in operation by 1965 and 1966 respectively.

The Sizewell station will incorporate a number of interesting technical advances in the concept of the gas-cooled graphite-moderated reactor fuelled with natural uranium. By adopting a plate thickness of over 4in for the spherical pressure vessel the design will be based on higher gas pressures and reduced circulator power. Improved fuel elements, stacked seven per channel, will permit the use of higher heat ratings and outlet gas temperatures.

The main departures from previous designs are inspired by the need to reduce physical size and, therefore, capital costs. For example, a single composite building will house the two reactors with various common services between them. This arrangement leads to economy in first cost and operation since both reactors can share the pile cap supervision services and the control room and associated staff changing rooms. It also enables the fuelling and servicing machine to be transferred from one pile cap to the other via a common maintenance shop. Again, with the object of reducing size and cost, the number of steam raising units will be reduced to eight (four per reactor) compared with twelve at Hinkley Point. Similarly only two turbo-alternators, each of 325MW capacity, will be needed to generate the electrical output.

As can be seen from the artist's impression, reproduced opposite, the two major structures, the reactor building and the turbine hall, have their longitudinal axes parallel to each other and roughly at right angles to the coast-line. The turbine hall has been sited to give a minimum length of circulating water culverts from the pumphouse. The circulating water pump-house, located in the sand-hills, is connected by twin tunnels to an intake structure some 1375ft offshore. The reactor cooling pond and decontamination facilities are grouped on one side of the reactor building, while the administration building, canteen, garages and workshops are sited together close to the access road. The 275kV switchgear is housed in a building to the west of the station.

Main Particulars of Sizewell Nuclear Power Station

Station :	
Net electrical output	580MW
Net thermal efficiency	30·5 per cent
Reactors :	
Number of reactors/station	Two
Reactor heat rating	950MW
Pressure vessel diameter	63ft 6in
Pressure vessel thickness	< 4in
Coolant	CO_2
Reactor inlet pressure	279 lb per square inch absolute
Fuel	Natural uranium
Fuel rod diameter	1·1in
Fuel charge/reactor	321 tonnes
Mean fuel heat rating	2·95MW (heat)/tonne
Number of elements per channel	Seven
Boilers and Turbines :	
Number of boilers	Eight
Horsepower drum pressure	720 lb per square inch absolute
High pressure superheater outlet temperature	391 deg. Cent.
Low pressure drum pressure	305 lb per square inch absolute
Low pressure superheater outlet temperature	390 ceg. Cent.
Steam pressure at high pressure boiler stop valve	677 lb per square inch gauge
Steam temperature at high pressure boiler stop valve	389 deg. Cent.
Steam pressure at low pressure boiler stop valve	268 lb per square inch gauge
Steam temperature at low pressure boiler stop valve	389 deg. Cent.
Vacuum	29in Hg
High pressure steam flow from each boiler	5·4 by 10^5 lb per hour
Low pressure steam flow from each boiler	1·9 by 10^5 lb per hour
Boiler dimensions	91ft 6in by 22ft 6in
Number of main turbines	Two
Output of each turbine	324·75MW
Main Circulators :	
Number of circulators	Eight
Type of circulators	Vertical, single stage axial with variable stagger inlet guide vanes
Drive	Vertical squirrel-cage induction motor
Civil Engineering :	
Height of reactor building	193ft
Length of reactor building	400ft approximately
Mean thickness of concrete main shield	5ft 6in
Mean thickness of concrete supplementary shield	5ft
Distance across flats of main shield	72ft 3in
Height of concrete main shield	86ft 2in
Thickness of pile cap	11ft 9in
Foundation of reactor building	Reinforced concrete raft 225ft by 110ft by 8ft thick
Turbine hall overall dimensions	Approximately 385ft by 155ft wide by 94ft high
Pump-house dimensions	125ft wide by 133ft long

Reactor Building.—Each of the two reactors is to consist of a spherical pressure vessel 63ft 6in in diameter housing a graphite core supported on an orthogonal lattice grid of Warren girders. Four boilers and four main gas circulators are associated with each reactor vessel. The reactors are to be surrounded by a 5ft 6in thick concrete primary biological shield, forming main structural members of the building, and sealed in by an 11ft 9in thick roof extending over the area between the reactors. The control, service, plant and fuel store rooms will be sited between the reactors and supported on floors of various thicknesses up to 5ft. A supplementary shield, about 5in thick, is to be placed around the primary shield to mask the major shield openings for coolant gas and air ducts.

The pile cap area will be equipped with cranes able to pass over both reactors. This will give great flexibility of operation and with such good coverage over the reactors that a single central fuel discharge system can be used and only one cooling pond will be needed.

Fuel Elements.—An improved fuel element can has been evolved allowing higher heat ratings than in previous designs offered by this manufacturing group. The extended surfaces of the magnox can are to be of the polyzonal multistart helical thread type, which will permit an increase in outlet gas temperature. Seven elements are to be stacked in each fuel channel, with consequent improvements in reactor performance and reduction in fuel costs. The Hinkley Point stacking technique, with fuel loading and unloading from the pile cap, is to be used and a mean irradiation level of 3000MWD per tonne is expected.

Control.—Reactor temperatures and heat output are to be kept steady by an automatic reactor control system. Major alterations in reactor heat output will be made by changes in coolant gas mass flow, that is, by varying the setting of the circulator inlet guide vanes and by the operation of a gas by-pass system. Reactor gas outlet temperature will be controlled by a sector control-rod system and xenon reactivity override will be obtained by raising the inlet gas temperature.

Reactor Pressure Vessel.—The spherical vessel will have walls over 4in thick and an internal diameter of 63ft 6in. The vessel plates, preshaped and part welded at works, will be welded together at site into courses of a size to make full use of the Group's "Goliath" crane. The top of the reactor vessel is to be protected from the hot gas emerging from the core by internal insulation. The metal temperature will be further reduced by the use of a cooling cowl on the outer surface. The load of the core, supported at the vessel bottom on a fabricated grid, is to be transmitted through the vessel envelope by an annular cruciform section forging, characteristic of the Group's vessel designs. There will be approximately 300 nozzles and penetrations, ranging in size from the 6ft 6in internal diameter gas inlet and outlet openings to small sampling and test closures in each vessel.

Boilers.—There are to be four boilers per reactor arranged in pairs on opposite sides of the reactor building, each 91ft 6in in overall height and 22ft 6in in diameter, with shells fabricated from low alloy, high-tensile steel, which gives appreciable savings in metal weight and thickness and simplifies site fabrication and erection problems. Shell sections will be prefabricated at works and

sent by sea direct from the manufacturer's wharf to Lowestoft.

Boiler elements are planned in horizontal banks. The design of the heat exchange surface has advanced so far that each boiler will produce over 50 per cent more steam from a shell little bigger than those at Hinkley Point. As in the earlier stations, a dual pressure steam cycle will again be adopted but with a side-by-side superheater arrangement to give a maximum l.p. steam superheat. The number of shell penetrations is to be reduced by the use of trifurcations connecting groups of three elements into a single tube passing through a thermal sleeve in the boiler shell.

A feature of the design is the inclusion of a by-pass within the boiler shell to control the exit temperature of the gas from the bottom of the unit. The entrance of the gas to the by-pass passage is to be controlled by a valve system actuated from outside the boiler shell through a displaced bellows positive seal drive.

The bottom end of the boiler shell will provide space for the circulator, control valve and by-pass system, the whole unit being so arranged that it can be withdrawn from the bottom of the boiler for maintenance. Further developments in boiler control will make it possible for all the boilers to be operated while on load from a shielded room in the boiler house basement, thus eliminating the need for personnel to enter areas of radiation during operation.

Gas Circulators.—The coolant gas will be circulated by single-stage axial blowers with variable stagger inlet guide vanes. These blowers, one to each boiler, are to be driven by large constant-speed a.c. induction motors drawing power through transformers from the main station generators. Each blower, mounted vertically in the base of a boiler, can be readily withdrawn for maintenance. The flow rate through the reactor is to be controlled partly by the stagger of the guide vanes and partly by the operation of a by-pass system within the boiler.

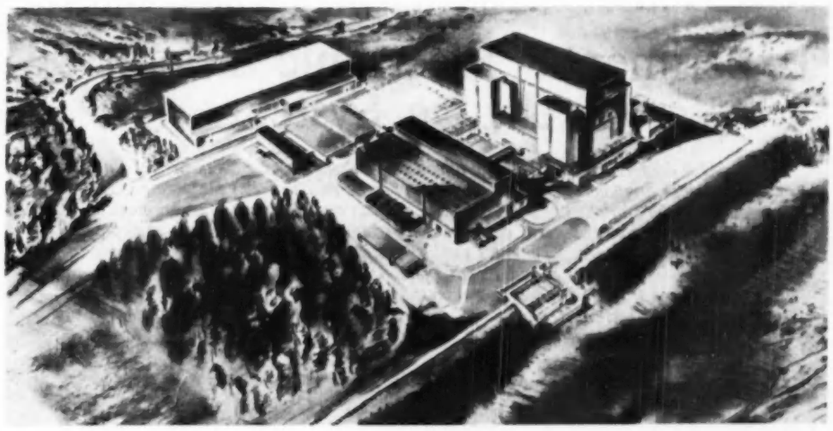
Cranes.—The permanent cranes for Sizewell nuclear power station will range in size from 2 tons to 250 tons, the most interesting being those on the reactor side of the station. The cranes to work over each pile cap will lift 250 tons on the main hoist and 80 tons on the auxiliary hoist, and are to be designed for accuracy of positioning and control. A novel transfer carriage will be provided to move the fuelling machines from one pile cap to another below the working floor level.

For operation over the cooling pond a " Goliath " crane is to be used, travelling on rails at a span of 93ft 6in and having a guided mast with grapple for handling the boxes containing spent full elements.

Electrical Plant.—Only two turbo-alternators, each rated at 325MW total capacity at a vacuum of 29in Hg, will be installed thus considerably reducing the size of the turbine hall. Each turbine is to be a 3000 r.p.m. in line tandem compound machine with one h.p. cylinder and multi double flow l.p. cylinders, the latter employing the longest exhaust blades yet manufactured. The turbines are to be mixed-pressure machines and one interesting point will be the use of bled steam to reduce exhaust wetness. The h.p. cylinder will use steam at 646 lb per square inch gauge and 700 deg. Fah, the l.p. cylinder taking steam at 253 lb per square inch gauge and 700 deg. Fah. The condensing and feed heating plant associated with the turbines is also included in the contract.

The three-phase, 50-cycle alternators, each rated at 382MVA at a power factor of 0·85 lagging, will generate at 17·5kV. Direct cooling will be employed, using water in the hollow stator conductors and hydrogen at a pressure of 45 lb per square inch gauge in the hollow rotor conductors, the hydrogen being circulated by a blower mounted directly on the main alternator shaft.

The power from the main generators will be distributed through two 340MVA, 17·5/295kV transformers and 275kV cables to the switch compound and the supergrid. The switchgear, subject of a separate contract, is to be housed in a steel frame building to meet the Central Electricity Generating Board's requirements for seaside sites.



A single building (right) will house the two reactors and boilers at the 580MW Sizewell nuclear power station. The electrical output will be generated by two 325MW turbo-alternators in the turbine house (centre). The switch house (left) will be clad in aluminium and glazing

Civil Engineering Work

The Reactor Building.—The buildings fall into three main groups ; the reactor building and turbine house ; the administration group with its associated workshops and welfare building ; and the switchgear house, to be largely clad with ribbed aluminium sheeting and patent glazing.

The 5ft 6in thick concrete walls of the biological shields will form a duodecagon rising to a height of about 96ft above the foundation. Internal diameter of the shields is to be about 72ft. The reactor structure will be carried on an 8ft thick concrete raft approximately 225ft by 110ft which transmits a load of about 3 tons per square foot to the sub-soil.

Turbine House and Ancillary Buildings.—The turbine house will be a steel framed building, about 385ft long by 155ft wide, divided by a longitudinal line of main stanchions into a 105ft wide turbine hall and 50ft wide mechanical annexe. Flanking it, and at a higher level, will be the electrical annexe. A number of smaller buildings will include an administration and canteen building, workshop and welfare building ; where regular movement of personnel between buildings is anticipated, there will be enclosed walkways and bridges.

Circulating Water System.—A major part of the civil engineering work will be the provision of the cooling water intake structure off-shore, through which water (over 27,000,000 gallons an hour) will be drawn for the condensers.

Driving the twin 10ft diameter tunnels, extending 1800ft from the on-shore shaft, through which the water will be conveyed, will take place on a three-shift basis. The excavation will be carried out in compressed air.

On the outlet side of the condensers, twin culverts will lead from the turbine house to a deep shaft. Twin tunnels will be driven from the bottom of this shaft to an outfall structure, the point of discharge being some 500ft beyond high water mark.

Concrete and Excavation Quantities.—Concrete, to be placed to a high degree of accuracy, will total to well over 200,000 cubic yards and will come from a batching and mixing plant with a capacity of 4000 cubic yards per week. The total amount of excavation required will be over 700,000 cubic yards, the bulk of which will arise from the site levelling operations, where a maximum cut of about 14ft will be made. Formwork will amount to approximately 300,000 square yards and over 5000 tons of structural steel will be used.

Construction.—Construction of the station, which will finally occupy 24 acres, will begin in April, 1961, and it is due to be completed in 1966. It is estimated that a peak labour force of 2400 will be employed, a substantial proportion of which is to be drawn from surrounding districts, and living accommodation will be provided on site for 1200. During the construction period the area occupied will be approximately 160 acres.

Owing to difficulties in providing a suitable road route direct to the site for heavy and bulky loads and the concern felt by the Ministry of Transport regarding the congestion on East Anglian roads, such loads will be sent by sea from the ports nearest to the manufacturing centres to Lowestoft and thence by road to the site, a distance of 26 miles.

The 400-ton " Goliath " crane, now on the Hinkley Point site, will shortly be dismantled and re-erected for use at the Sizewell site.

Sea transport will be used for the heaviest and most bulky pieces of plant. Road and rail services will be used to carry the major part of the many thousands of tons of engineering equipment needed for the station.

Boiler ring sections, reactor pressure vessel plates and lattice-grid trusses will be shipped from the Clyde from a deep water berth at works. Alternator stators and rotors, turbine rotors and similar items will be shipped from Merseyside. All these heavy items will be received at the Corporation-owned South Quay at Lowestoft Harbour where a heavy lift 200-ton crane is to be installed.

Architects and Consulting Engineers.—Consulting architect to Taylor Woodrow Construction, Ltd., for the Sizewell project is Frederick Gibberd, G.B.E., F.R.I.B.A., M.T.P.I., F.I.L.A. and consultant engineers for the cooling water pump-house and off-shore works, C. S. Allott and Son.

Experimental Electronic Telephone Exchange System

A two-day conference on electronic telephone exchanges was held at the Institution of Electrical Engineers, London, on November 22 and 23. Papers were presented explaining the work being carried out in Britain and other counties on electronic exchange techniques, several of them dealing in particular with the development of equipment for an experimental public service electronic telephone exchange to be installed at Highgate Wood, North London, probably in the next year or so. An introduction to the Highgate Wood system was given in a paper by L. R. F. Harris, V. E. Mann,† and P. W. Ward‡, extracts from which appear below.*

WHEN the Highgate Wood design was begun, a wide variety of electronic system and circuit techniques were available which, between them, offered solutions to all the basic problems in designing a telephone system, and it was agreed that the experimental exchange should be designed to gain experience of a number of them in the field.

The basic time-division-multiplex techniques had been studied in some detail when the system features of the experimental exchange were being considered. Both use common circuits called highways on which each connection is made with one of a series of interleaved cyclically recurring pulse channels, speech being transmitted in the form of pulse samples from which the modulating waveform is recovered using a low-pass filter. One technique, using two-wire bidirectional highways, requires that the full speech power be passed through the switches at the sampling time ; with the devices available at the time the number of channels on any one highway was limited to about thirty. The alternative technique is to use unidirectional highways with two-wire to four-wire conversion in the line terminal equipment. Many more channels can then be accommodated on a highway, and as the number of highways is reduced by time-sharing them among as many simultaneous connections as possible, particularly in large exchanges, it was decided to use four-wire transmission. Some amplification is then required in the demodulators, and in order to meet crosstalk and other transmission requirements with readily available devices, each highway was restricted to 100 channels at a repetition rate of 10kc/s. This gives one microsecond for each sample[1].

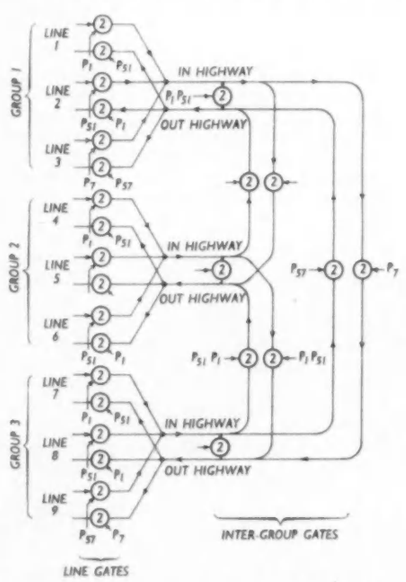
Two switching techniques form the basis of a wide variety of t.d.m. systems.[2] First, a number of audio circuits may share a highway, and by suitably pulsing gate circuits interconnecting the audio circuits and the highway, each channel can be connected to any audio circuit as required. Secondly, coincident channels on different highways can be connected together by suitably pulsing gates interconnecting the highways. For the experimental exchange, attention was concentrated on those arrangements in which samples could be transmitted directly from one line to another. In such systems common t.d.m. circuits can be used very efficiently throughout the transmission path and gain variations arising from the demodulation or storage of pulse samples are minimised.

Interconnecting Gates

Basically the external lines are arranged in groups and all the lines in a group are connected by gates to a pair of group highways, one for each direction of transmission. Each in-highway, carrying samples from the lines into the exchange, is connected by inter-group gates to each out-highway. Speech may then be transmitted from one line to another using coincident channels on the in-highway of the transmitting line's group and on the out-highway of the receiving line's group.

If the two lines are in different groups, identically timed channels can be used for the two directions of transmission. However, for connections between lines in the same group, the same highways are used for both directions of transmission between the lines, and in order to avoid unacceptable sidetone, differently timed channels must be used for the two directions of transmission. This is most conveniently achieved if the gate connecting a line to its group's out-highway is always pulsed a fixed interval after pulsing the in-gate. In one arrangement this fixed interval is made equal to the channel spacing, i.e. one microsecond. However, this technique requires delays to be inserted in the highways, which can be avoided if the line gates are pulsed half a cycle, i.e. fifty microseconds apart. For this reason, this so-called antiphase technique was adopted for Highgate Wood.

The basic trunking is indicated in the accompanying diagram where the highways of three groups each of three lines are shown, together with the line and inter-group gates. The channel pulses applied to the various gates for a number of typical connections are also shown. Lines 1 and 2 in group 1 are connected together using channel P_1 for transmission from line 1 to line 2, while the antiphase channel P_{51} is used in the reverse direction. P_1 and P_{51} are thus busy on both the in- and out-highways of group 1 and cannot simultaneously be used on other calls in that group. Other channels can be used, however, and the diagram shows a connection between line 3 and line 9 in group 3 using channels P_7 and P_{57} for the two directions. In addition, the use of channels in group 1 does not preclude their use for simultaneous connections involving other groups. Thus, P_1 and P_{51} can be used for two other connections between lines in groups 2 and 3. P_1 transmits from line 4 to line 8 and also from line 7 to line 6, while P_{51} is used in the reverse directions of both connections. The three connections using P_1 and P_{51} do not interfere with each other because the gates interconnecting the unwanted pairs of highways are not opened at these channel times.



Interconnection of subscribers lines through "highways" and pulsed gates

Because any line or inter-group gate can be opened for any of the 100 channels, a connection between a pair of lines can be set up using any free channel on the in-highway of one line's group, provided that its antiphase channel is free on the in-highway of the other line's group. Because channels are used by connected lines only, the number of lines in a group can exceed the number of channels by an amount depending upon the traffic.

Coded Pulse Stores

While each gate could be connected to a pulse store which generated only those pulses required to be effective in that gate, in general it is more economical to use a coded arrangement so that a pulse is only effective in a gate if it is generated coincidently by a particular combination of stores. A set of coded stores can feed a group of gates provided that each pulse is only required to be effective in one of the gates. This condition is met in the group of gates connecting a group of lines to its in-highway, where the need to avoid double connections requires that each channel is used by only one line at a time. While the number of stores is minimised if binary coding is used, the problem of decoding the store outputs is simplified at Highgate Wood by relating the coding to the physical arrangement of the line units.

While separate pulse stores could be used to feed the antiphase pulses required to connect a line to a channel on the group out-highway, it is clearly more economical to use the same stores if possible. In the Highgate Wood system this is readily achieved by using 100 microsecond magnetostriction delay lines with centre-tap outputs to supply the antiphase pulses. These antiphase outputs are decoded in a precisely similar manner to the main outputs.

With the basic connection-path features settled, the question arose as to whether connection control should be exerted on the lines over the connection switch using the speech channels or whether a quite independent control using different paths should be used.

An advantage of four-wire t.d.m. systems is the ease with which signals can be transmitted through the switches. For example, the mere presence or absence of channel pulses on the group in-highway can be arranged to indicate the loop condition of subscribers' lines. Similarly, call progress tones can be sent to line by transmitting modulated channel pulses over the out-highway. In addition, the two speech highways can be augmented by additional signalling paths between the line termination equipment and the highways. These paths

* Post Office Research Station.
† British Telecommunications Research, Ltd.
‡ Research Laboratories of The General Electric Company, Ltd.

can parallel the speech paths and be made via gates controlled by the same pulse feeds. Because these signalling paths were readily available, independent control was considered to be an unnecessary complication and it was decided to control connected lines via the switches.

Line Information Stores

It was decided to enable any directory number to be associated with any equipment position. In electro-mechanical systems such flexibility is obtained using a distribution frame in which equipment and directory number terminals are cross-connected. The same facility can be given by any large-capacity information store, but it is advantageous to use a device which is capable of storing, not only the permanent information relating to a line, but also the variable information such as the subscriber's meter record. Such storage facilities are readily available using the magnetic drum, and in the Highgate Wood system this is used to store all the permanent and semi-permanent line information.[3]

The arrangement adopted is to provide each sub-group of 100 lines with a number of tracks, each track being subdivided into 100 words of twenty-eight bits each. The drum storage positions can then be systematically associated with the line units, and a line's equipment number, i.e. its combination of line connection stores, can be derived directly from the position of its line information on the drum.

A feature of the magnetic drum is the ease with which information can be read or changed, if necessary from a remote point. Thus, the class of service or directory number of a line is readily changed without the need to change the line equipment or to run new jumpers through a distribution frame. In addition, the use of the magnetic drum for metering enables meter records to be read automatically, and hence the experimental exchange will provide useful experience in techniques leading to complete mechanical accounting.[4]

In order to detect that a line is calling it is unnecessary to examine its loop condition continuously, periodic sampling being sufficient.[5] When a line is detected as calling, the combination of connection stores of the calling line is staticised.[6] An indication of its group is given to a channel selector together with an instruction that connection to the register equipment is required. In addition, the fact that the calling line is busy is recorded on the drum operate track.

The channel selector operates to select a channel which is free in the calling line's group and in the register equipment, and writes the selected channel into the indicated combination of line connection stores and into the register connection store connecting that line's group to the register.[7] It also writes relevant class-of-service and type-of-line information into the register stores. The connection of the calling line to the register is then made and the channel selector and staticisors can be released. Scanning, inhibited for the few milliseconds required to set up the connection, is then resumed.

Register Functions and Translation

The line conditions of the calling line are passed into the register apparatus over common signalling paths. By examining these conditions and storing the deductions made, dial breaks, makes and inter-train pauses are detected and the received designation digits stored in appropriate positions in the 900 microsecond delay lines.[8] In the general case the digits received by the register may include a prefix, an exchange code and numerical digits corresponding to the directory number of the wanted party, line or group of lines. These digits are instructions to the exchange to connect the calling line to a free one of a group of lines which may or may not be in the same exchange. In order to carry out the instructions—and charge for doing so—the digits must be converted into other signals which indicate the suitable routes out of the exchange, the information, if any, which must be sent over the selected route to further the progress of the call, the charge for the call, the number of digits to be received before the connection is set up and so on. Such translation processes are performed on a one-at-a-time basis, the relevant digits being staticised and offered to a library of information from which the appropriate translation can be obtained.

Part of this library is available in the line information stores where the directory number or numbers of each line are stored on the drum in a word position identifying its equipment position. On locally terminating calls it is therefore sufficient to staticise the numerical digits received from the calling line and compare them with the directory numbers on the drum tracks. This comparison takes place in the line comparator. When coincidence is obtained, the state of the line can be deduced from the operate tracks, and, if the line is free, a final connection between the calling and called lines is set up.

The channel selector can set up a locally terminating call by selecting a channel which is free on the in-highways of the calling line's group and whose antiphase channel is free on the in-highways of the called line's group. The speech connection is then set up by writing the selected channel pulses into the appropriate line and inter-group connection stores. In addition, the staticised class-of-service information is written into the common supervisory apparatus in order to control the call in the appropriate manner.

On outgoing junction calls, routing digits stored in the register must be sent over the out-signalling path to the outgoing junction in order to further the setting-up of the call. In general, the channel with which this information is stored will not coincide with that used on the final connection to the outgoing junction and a time displacement must occur. The problem is overcome with pulse-changing links which can connect any channel in the register equipment to any channel in any group. The register indicates each dial break to be sent to the register link. Its output is passed as a train of pulses modulated by the dial breaks via the common supervisory equipment to the out-signalling path. By this means the register can send pulses over the outgoing junction and can clear itself from the connection when all digits have been sent.

General Comments

While the main purpose of the Highgate Wood experiment is to gain experience of a variety of techniques, the circuit diversity and overall power (and ventilation) requirements due to the extensive use of hot-cathode valves are clearly features which cannot be carried forward into a practical system. Transistor techniques are now available to meet all circuit requirements more uniformly, and these will greatly reduce the amounts of power and space needed.[9]

In addition, the system is unnecessarily complex in that the speech-channel apparatus, the magnetic drum equipments and the time-sharing waveforms by which the signalling paths are shared over different functions are all asynchronous with each other, and this has tended to complicate the boundary equipment transferring information between sections.

In its present form the system suffers, as a competitive practical system, from the very diversity of techniques that it has been designed to test. Nevertheless its general system organisation is not unsuitable for large exchanges, and the use of transistors and simplication should produce an attractive system applicable to a wide range of exchange sizes. The project has been successful in clarifying the problems posed by introducing electronic exchanges into the network and is expected to prove an important step in progressing towards the system of the future.

References

[1] Duerdoth, W. T., French, J. A. T., Crossley, C. G., and Rous, R. F., "T.D.M. Exchange Speech Switching Equipment" (Conference paper).

[2] Ward, P. W., and Harris, L. R. F., "Time-Division Multiplex Electronic Telephone Exchange Trunking Systems" (Conference paper).

[3] Knight, R. G., and Mann, V. E., "Principles of Connection Control by Magnetic Drum—General Description" (Conference paper).

[4] Hunter, N., and Knight, R. G., "Principles of Connection Control by Magnetic Drum—Meter Records" (Conference paper).

[5] Allum, R. D., and Knight, R. G., "Electronic Telephone Exchange—Principles of Connection Control by Magnetic Drum—Line Scanning Processes" (Conference paper).

[6] Arnold, J. S., and Bryan, D. G., "Electronic Telephone Exchange. Principles of Connection Control by Magnetic Drum—Originating Calls" (Conference paper).

[7] Bishop, D. K., Caplin, J. S., and Grundy, S., "A Channel Selector for a T.D.M. Electronic Exchange" (Conference paper).

[8] Flood, J. E., and Simmons, B. D., "Register Equipment for a T.D.M. Electronic Telephone Exchange" (Conference paper).

[9] Leakey, D. M., "T.D.M. Electronic Exchange Transistorised Transmission Equipment" (Conference paper).

Low-Distortion Transistor Oscillator

A RESISTANCE-CAPACITY oscillator with low harmonic distortion characteristics, based on a design by the Royal Radar Establishment, has been introduced by Solartron Laboratory Instruments, Ltd., Cox Lane, Chessington, Surrey. The oscillator, CO.1008, covers a range of 20 c/s to 200 kc/s. Frequency may be set to an accuracy of ±5 per cent with the fine control dial, and is held to within 0·2 per cent of the set frequency over an eight-hour period. Output, which is continuously variable up to 1V amplitude, contains less than 0·25 per cent total harmonic distortion above 100 c/s, and less than 1 per cent below 100 c/s.

The oscillator uses the virtual earth technique employed in computing amplifiers to provide highly stable characteristics. Frequency control is by resistive tuned Wien network, and amplitude stability of ±2 per cent is achieved by thermistor feedback. The instrument, shown in the accompanying illustration, weighs only 4½ lb including two 9V internal batteries, which have a life of three months based on four hours per day usage.

Transistorised resistance-capacity oscillator for 20 c/s to 200 kc/s

Screw Design Air Compressor

For many years Sir George Godfrey and Partners (Industrial), Ltd., of Hampton Road West, Hanworth, Middlesex, has specialised in the design and manufacture of Roots type blowers and superchargers. This design of blower is used in a variety of applications, particularly where large flows of oil-free air are required at moderate pressures, and the range now in production includes machines capable of operating at pressures up to 13 lb or 15 lb per square inch. It became apparent some time ago that there was a market for a machine capable of delivering oil-free air at pressures up to 30 lb per square inch without the need for resorting to two-stage Roots installations. The firm, therefore, acquired a licence from Svenska Rotor Maskiner of Stockholm under which it has developed the "Godfrey/SRM" type 220 compressor shown in our illustration. This machine delivers up to 450 cubic feet of oil-free air per minute at 30 lb per square inch. Its overall performance can be seen in the graph we reproduce, whilst the drawing shows its general construction.

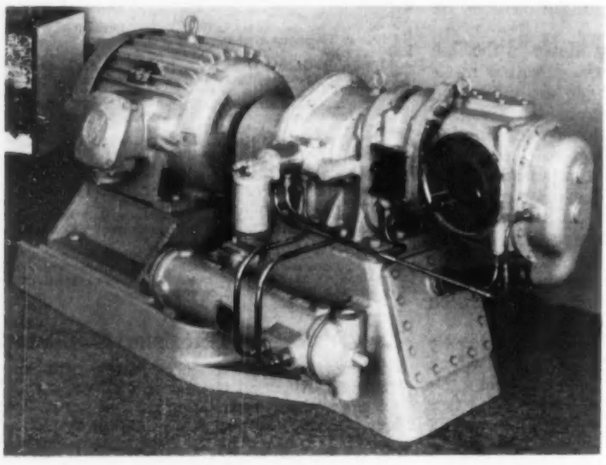
This positive displacement, rotary, screw compressor with a "built-in" pressure ratio is surge-free in operation and, having no reciprocating parts, is free of any vibration when running. Such screw compressors have a high volumetric displacement for a given size and can operate over a wide band of pressure ratios without a significant loss in efficiency. They run at up to 30,000 r.p.m. and it is stated that temperature efficiencies vary between 65 and 75 per cent whilst mechanical efficiencies of 83 to 92 per cent inclusive of gearbox losses can be achieved. The volumetric efficiency, which is nearly independent of pressure ratio and can approach 100 per cent, varies almost directly as the rotor speed. When running there is no contact between the rotors or between the rotors and casing and no internal lubrication is required—effective sealing being provided by small running clearances. The male rotor is driven and takes the full driving torque, the female rotor being driven by timing gears and acting as a rotary seal.

A standard synchronous motor is generally used for driving these compressors and to provide the necessary speed increase a compressor is mounted on and driven through a step-up gearbox. In a typical installation, as shown in our illustration, the compressor and gearbox assembly is mounted on a common baseplate with the driving motor, a lubricating oil tank and oil cooler.

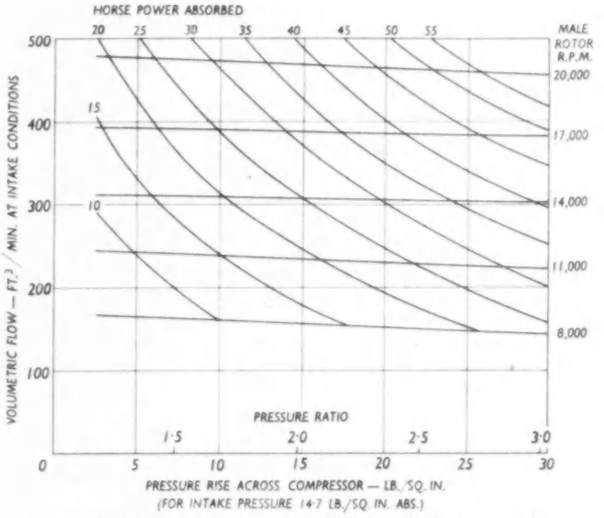
The compressor in this case consists of two helically-lobed intermeshing rotors which rotate in a close fitting chamber; the male rotor having four lobes and the female rotor six corresponding gulleys. The one-piece steel rotors, supported at each end in plain bearings, are located axially by ball bearings at the free ends. Oil leakage into the rotor chamber is prevented by labyrinths and carbon seals fitted between each bearing and the chamber, the space between the bearings and seals being vented to atmosphere. At the drive end, the male rotor is coupled to the gearbox output shaft by a quill shaft. The rotors are phased by timing gears mounted on their shafts at the free end, the driven gear on the female rotor shaft being split to allow initial setting of the inter-rotor clearance.

The rotor chamber consists of a cast iron casing machined internally to a figure-of-eight section and closed by an inlet casing at the drive end. The timing gears at the free end are enclosed by an end cover and provision is made for water cooling the rotor casing. The arrangement of the air inlet and outlet ports on the same horizontal plane on opposite sides of the compressor facilitates the installation of a compressor in a duct system.

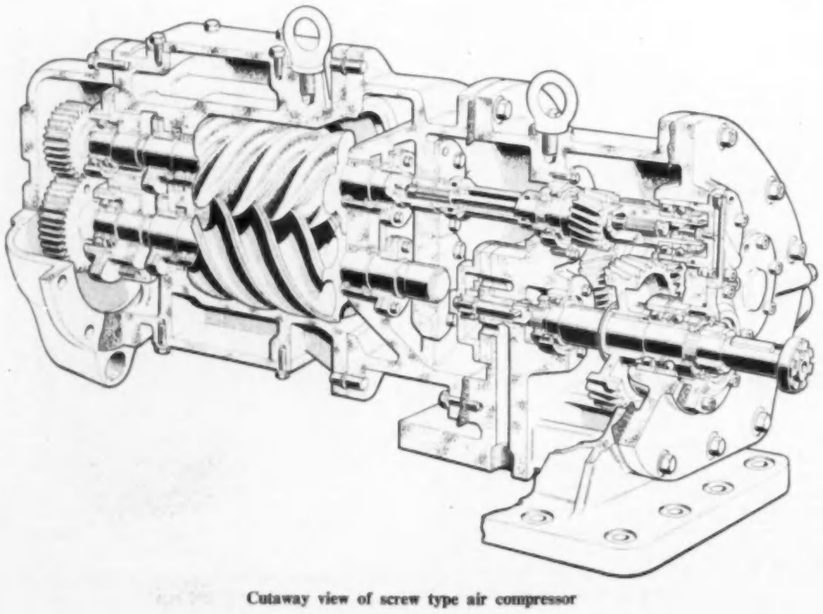
In the operating cycle of the compressor air entering the inlet port fills the interlobe space between the rotors. This space progressively increases with continued rotation of the rotors, the volume of air inspired depending on the wrap angle (in this machine 300 deg.), which determines the amount of "unwrapping" of the male lobe from its associated gulley before it is cut off from the inlet port by the succeeding lobe and gulley. The air is carried circumferentially around the rotor case through one half revolution of the rotors, then a male lobe starts to mesh with the gulley from the inlet end towards the outlet end of the casing. This action takes place simultaneously with the unmeshing of another gulley diametrically opposite, therefore intake and discharge take place at the same time, but on opposite sides of the rotors. Further angular movement of the rotors causes the meshing to proceed axially towards the outlet port, thereby reducing the volume of the interlobe space and compressing the air contained therein. This process continues until the interlobe space reaches the outlet port, when further meshing of the rotors discharges the air from the casing—the degree of internal compression being determined, therefore, by the axial extent of the outlet port.



Screw type air compressor set for delivering up to 450 cubic feet of oil-free air per minute at 13 lb per square inch



Performance of a screw compressor having a standard rotor speed/input shaft ratio of 6·8 : 1



Cutaway view of screw type air compressor

SHORTER REPORTS

Anglo-American Summer School on Industrial Archaeology

THE University of Manchester Extra-mural (Extension) Department is arranging a Summer School on industrial archaeology for two weeks from July 15 to 29, 1961. Most of those attending will, it is expected, be from the United States and Canada, but a number of British delegates will be accepted. Those taking part will be accommodated at Woolton Hall, a newly-built Hall of Residence of Manchester University. A feature of the School will be a series of organised visits to sites of industrial interest over a wide area of Northern England and the Midlands. These visits will be directly related to the lectures to be given by a number of specialists in different branches of industrial history.

Manchester is not only the centre of an area which played a very important part in the Industrial Revolution ; its University has the oldest Chair of Economic History in Great Britain, and has for a long time been a leading centre of research and teaching of the subject. It is thought appropriate that this ambitious scheme should originate at Manchester at a time when the importance of the long-neglected subject of industrial history—particularly in the period from the sixteenth to the nineteenth centuries—is beginning to receive the attention it deserves. Full details of the School, with the names of the lecturers and a basic timetable, are available from the Director of Studies, Extra-mural Department, the University, Manchester, 13.

Reverse-Cycle Refrigeration

AMONG the Chrysler-Airtemp refrigerating plant now marketed in Great Britain by the Special Products Division of Chrysler International from its Kew, Surrey, factory are units which can be reversed to act as heat pumps. In the case of water-cooled water-chillers, this is of course easily effected by interchanging the water connections to the evaporator and condenser, but it is also achieved on air conditioning plant by reversing the flow of refrigerant around the circuit. Our illustration shows an air-to-air plant for conditioning a single undivided space ; at the far end is the " inner " heat exchanger, over which the air in the space is circulated by a fan, and at the rear end is the " outer " heat exchanger with another fan ; a duct between the two fan circuits can be opened to introduce fresh air to the building. The refrigerant, Freon 22, delivered by the pump passes to the solenoid valve seen in the foreground and is directed to whichever heat exchanger is to be heated. It passes from condenser to evaporator through a long capillary that imposes a pressure drop, and from the air cooler arrives again at the solenoid valve and is directed to the pump suction. The valve, like the compressor, is completely sealed and only electric leads pass through the envelope ; they are embedded in " Fusite " glass seals. Plant in this series, known as " Slender " from its depth of less than 18in, of which only 2in enter the space, does not exhaust stale air from the building, since to do so would adversely affect the coefficient of performance, which ranges between 6 and 7. This plant is controlled not only by a thermostat but also, when used as a cooler only, by a humidity monitor ; de-humidification is effected by draining moisture off the air-to-fluid heat exchanger, allowing it to run along the base tray of the plant (the steel tray is protected from corrosion with zinc and paint, and the water is prevented from spreading where not desired by dams of putty) to the outer fan, which has a slinger ring that picks up the water and disperses it in the outer air flow ; at 50 per cent relative humidity, moisture removal rates range from 1½ pints to 3½ pints per hour.

Airtemp refrigerators use radial compressors with a single bank of cylinders in a shallow spiral to allow individual connecting-rods, instead of master and slave rods, to be used. The compressors are unloaded for starting and regulation by holding open the inlet valves of one or more cylinders. An oil heater is provided to prevent the refrigerant diluting the lubricant and, in the compressors with glands and air-cooled motors, the lubrication systems run independently of the direction of pump motion so that two compressors can be attached to opposite ends of a motor.

The ranges of Airtemp products now marketed in this country number nine :

(1) Radial condensing/compressor sets 15 h.p. to 100 h.p. with water-cooled and evaporative condensers.

(2) Radial compressor chilled water and brine coolers 25 h.p. to 100 h.p.

(3) Serviceable sealed condensing units 7½ h.p. to 30 h.p. water and air cooled.

(4) Hermetic condensing units 3 h.p. to 7½ h.p. water and air cooled.

(5) Evaporator blower units, 3 tons to 30 tons refrigeration plus complementary air handling units.

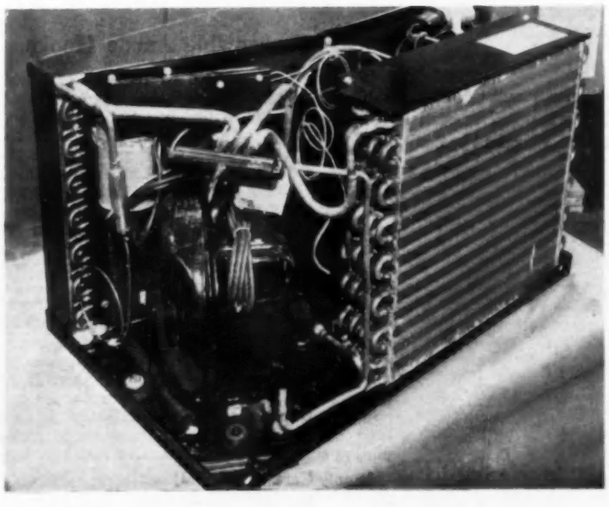
(6) Liquid chillers water and brine 3 tons to 100 tons refrigeration.

(7) Packaged air conditioners, hermetic and serviceable sealed compressors air and water cooled 3 h.p. to 30 h.p.

(8) Packaged air conditioners, radial compressors, water and evaporative condensers 25 h.p. to 75 h.p.

(9) Hermetic and serviceable sealed compressor 3 h.p. to 15 h.p. for manufacturing projects.

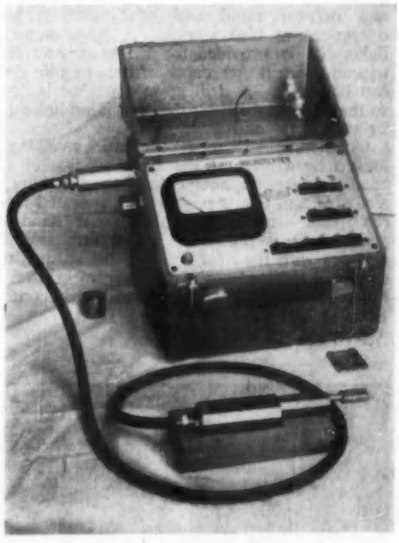
[Reply Card No. E9412]



In the foreground is the sealed solenoid valve that connects the compressor, below it, to the heat exchangers in alternative sequences. Also visible is the capillary tube leading from the condenser to the evaporator, and, below it, the tube leading water condensed from the conditioned air on to the tray below the outer fan

Surface Finish Measurement

We illustrate below a new version of the " Diavite Microtester " surface finish measuring instrument which has been introduced by Payne Products International, Ltd., Lawrence Estate, Green Lane, Hounslow, Middlesex. The earlier design of this instrument was fitted with a meter showing centre line average readings and a graduated scale and selector knob used for the determination of maximum scratch depth (from the mean centre line). When the selector knob was set to the indicated value of the scratch depth, a red warning light flashed once per stylus stroke. The improved instrument now provides a meter reading which, by push-button selection, indicates any one of the following values : R_a (Centre line average) ; R_p (Maximum height of profile from mean centre line) ; and R_{max} (Maximum depth of scratches, peak to valley).



Surface finish measuring instrument

The maker states that, although British Standard No. 1134:1950 stipulates the use of the centre line average system, the ability to determine the R_{max} value is of considerable value when it is necessary accurately to determine the surface damage of the work. For example, in transistor manufacture, where etching is used to remove all traces of surface damage from semiconductor slices, it is possible to predict the depth to when etching must be carried out.

The instrument continues to cover the range 0-300 micro-inches, with three available " cut-off " lengths (waviness limited) of 0·003in, 0·010in, and 0·030in. A special model now obtainable provides three alternative stroke lengths between 1mm–2mm, and a pen recorder can be supplied for providing permanent records of surfaces.

[Reply Card No. E9413]

SHORTER REPORTS *(Continued)*

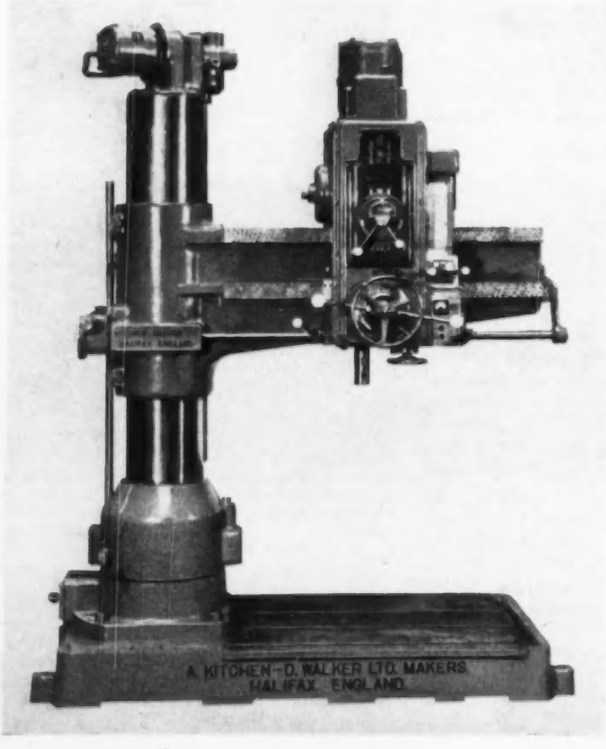
Radial Drilling and Tapping Machine

A RADIAL arm drilling machine recently introduced by A. Kitchen-D. Walker, Ltd., Hexagon Works, Pellon Lane, Halifax, Yorks, is available in a range of sizes from 3ft to 5ft maximum spindle radius. This new machine has a drilling capacity of up to 2in diameter in mild steel and, of the same basic design, is a companion machine to the firm's heavier 3in capacity model introduced a year ago. As can be seen in the illustration, the column is of pillar and sleeve construction and the head, powered by a 5 h.p. motor, is supported on the arm by ball bearing rollers in both the vertical and horizontal planes. Traverse of the head on the arm is by handwheel and rack and pinion. Eighteen spindle speeds, 1560 to 25 r.p.m., and nine power feeds giving 280 to twenty-four cuts per inch are available together with quick and fine hand adjustments to the spindle. Sensitive drilling of small holes is effected by a well-spaced double lever at the front of the head.

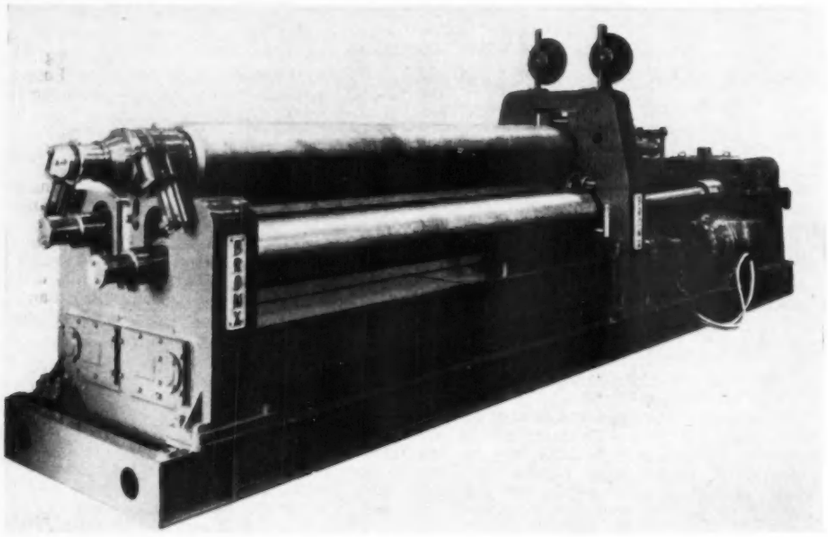
Control of starting, stopping, reversing and inching is by a master controller conveniently placed at the bottom right-hand corner of the head. This controller works in conjunction with generously rated forward and reverse contactors and permits rapid and continuous tapping operations at high speeds. A large diameter index dial is provided for the automatic feed trip and with it any depth of hole to 14in deep can be preset. A drill point corrector is fitted so that the full diameter depth of blind holes can be accurately controlled.

On the standard model the entire machine is locked by a lever at the left-hand side of the head ; as an optional extra power locking is available and this is push-button operated from the head. Irrespective of whether hand or power lock is fitted, the radial arm may be elevated with the lock applied, this ensures the spindle is retained in the true alignment over a hole. Arm elevation under push-button control is by 1½ h.p. motor.

[Reply Card No. E9421]



2in capacity radial drilling machine available in models of 3ft to 5ft spindle radius



Pinch-pyramid rolls for plate up to 10ft wide by ¾in thick

Pinch Pyramid Plate Bending Rolls

A NEW range of pinch pyramid bending rolls has been developed by the Bronx Engineering Company, Ltd., Lye, Stourbridge. In these machines the rolls are arranged in pyramid form, but instead of the top idle roll being provided with vertical adjustment, the two bottom driven rolls are adjustable vertically either independently or simultaneously. To allow this vertical movement, the two bottom rolls are driven through universal couplings from the main gearbox of the machine. With this design, plates can be rolled in the same way as in the case of the normal three-roll pyramid machine but in addition, both long edges of a plate can be pre-formed prior to rolling without taking the plate out of the machine as is necessary in the case of a standard three-roll initial pinch bending roll.

The illustration shows a machine having a capacity for prebending and rolling mild steel plate 10ft in width by ½in thick, and for rolling plate 10ft in width by ¾in thick. This particular machine has roll necks extending outside the housings on the swing down end. Various types of roll can be fitted to these extensions and used for the bending of angles and other sections.

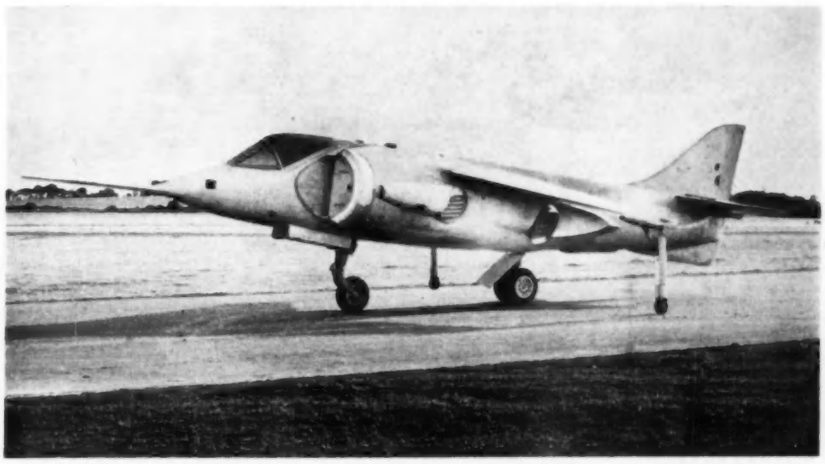
To allow the removal of completed cylinders from the machine the top roll is balanced from the drive end and at the non-drive end the bearing housing swings down. Both these operations are carried out by pneumatic means, the controls of which are combined so that only one movement is necessary by the machine operator. Large indicator dials fitted at the drive end show the movement of the bottom rolls, and electric limit switches are fitted to prevent damage to the machine should the bottom rolls be accidentally over-run either up or down.

[Reply Card No. E9422]

Non-Consumable Anode Hooks

WE have been advised by Imperial Chemical Industries, Ltd., of a further application of titanium in nickel plating in addition to its use for steam heating coils ; this is to form the hooks with which the anodes are hung in the solution. Conventional practice is to use a hook of nickel ; such a hook will naturally dissove in the bath, so that it is necessary to keep it clear of the solution and the top inch or so of the anode is therefore unusable, and the hook is paid for at the same rate as the rest of the anode. A titanium hook is so nearly unaffected by nickel plating solutions that it can be threaded and screwed into a succession of anodes, and the anode immersed completely in the solution. Hooks of this design which were introduced into service in 1958 show, we are informed, no deterioration other than wear on the thread, and are estimated to be only half-way through their useful life. Both dull and bright nickel plating solutions are non-reactive with titanium.

[Reply Card No. E9423]



The Hawker P.1127. The cockpit transparencies are covered over and some panels missing. Three of the undercarriage legs retract backwards, indicating that approaches are not expected to be hurried

Flat-Rising Jet V.T.O.L.

LAST week there took place the first flight of the Hawker P.1127; it is the first V.T.O.L. aircraft designed as such to make a flat-rising take-off purely on the reaction of the jets used for thrust in forward flight (tail-sitter jets and rebuilt conventional aircraft have, of course, demonstrated not only take-off but also transition on many occasions during the 1950s). The engine is the Bristol-Siddeley BS-53 ducted fan, which was illustrated and described in outline on page 278, August 12 last. (It should be recalled that the first jet aircraft in which the thrust vector, as distinct from the engine itself, could be turned to act along the lift axis, the Bell X-14, had engines built by a forerunner of this firm, i.e. a pair of Armstrong-Siddeley "Viper" pure jet engines; the BS-53 is not, in fact, descended from this pioneer engine, being derived rather from its nearest Bristol equivalent, the "Orpheus.")

It is hardly necessary to mention that a jet V.T.O.L. is virtually certain to be thrust limited, and the severity of this limitation has caused the development of this class of aircraft to lapse into abeyance in, particularly, the United States of America. Consequently, it is not surprising to observe in the photographs now available that the P.1127 takes very much the form of some fighters of before the 1939 war in comprising a minimum of airframe in addition to its engine. Bifurcated intake and exhaust ducts have long been favoured in Hawker designs to reduce weight, and discarding the single jet pipe that appeared on the "Hunter" has avoided reviving the now ill-favoured tail boom configuration. Since the weight of the airframe and load is so critical, the refinement of envelope, strength, and stiffness needed for supersonic flight have not been attempted, so that despite its relatively great thrust the P.1127 is probably of much the same maximum speed as contemporary fighters with the "Orpheus."

It will be observed that the two photographs do not show the aircraft in similar configurations; while the side view shows various small panels missing, in flight it is seen without the nose probe, main undercarriage doors, and outrigger leg fairings. A reaction control nozzle for pitch and yaw control can be seen just below and behind the nose probe, and a second such nozzle may be carried in the bullet, behind the moving tailplane, which appears to be fixed. There is no sign of nozzles for lateral control, however, and it may well be that none are fitted, on the grounds that conditions of zero wind and zero available ground run are unlikely to obtain together; this hypothesis receives some support from the fact that the machine is seen hovering with a pair of spring-extended skids added to the outriggers, thus endowing it with stability in roll at heights of a few inches. It may not be obvious from reproductions of the original photographs that the large-radius lips of the intakes blend very poorly with the contours of the fuselage; by analogy with the earliest photographs of the F-104A, it may be surmised that these are but temporary covers concealing details of the intake system.

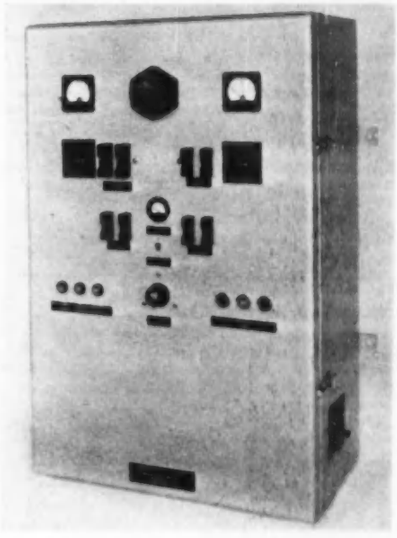
Hovering flight; at the starboard wingtip is a cable to carry the pilot's telephone circuit

No indication of the imminence of trials in the normal flight regime has been given. The dimensions of the machine are quoted as: length 41ft 2in, span 24ft 2in, height 10ft 3in.

Mains-Failure Generator Control Panel

THE "Sicon" mains-failure generator control panel, illustrated here, is designed to work with a diesel generator set to provide continuity of electricity supply for essential services, such as hospitals, or industries where interruption of supply would be unacceptable. The panel is made by Southern Instruments, Ltd., Frimley Road, Camberley, Surrey.

Its function is to sense any loss or partial reduction of mains voltage and then to provide a starting signal to a diesel engine generator set. The mains supply is automatically isolated from the load and the alternator connection made to the load after the output has built up to the required voltage and frequency. On restoration of supply from the mains, allowing also for transient restorations, the load is disconnected from the alternator and reconnected to the incoming supply and the engine is automatically stopped. Provision is made for local control so that the engine may be exercised for maintenance purposes. Fault indicators and alarms to register



"Sicon" mains-failure generator control panel of 100A rating for a 70kVA generator

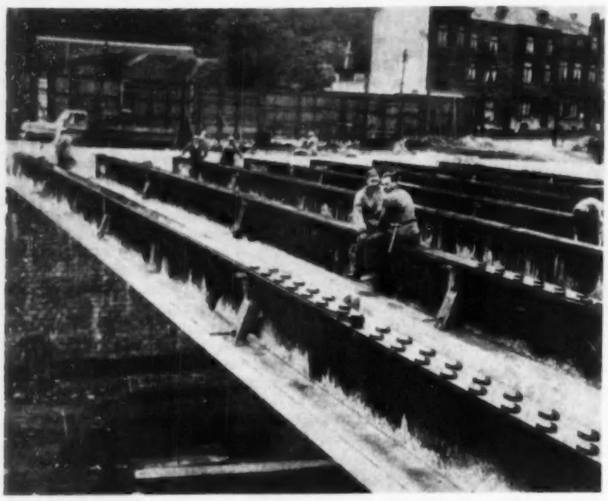
engine defects such as failure to start, excessive engine temperature, or low lubricating oil pressure, can be fitted, as required. A battery trickle charger is usually included.

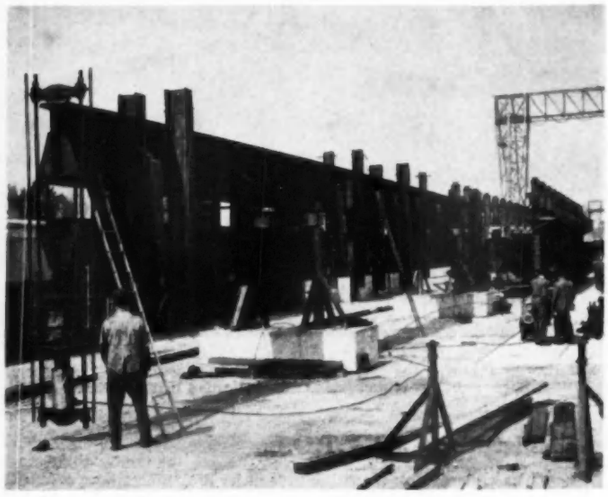
In the control panel the mains failure sensing device consists of three relays, which detect a complete loss of voltage, and a hot-wire vacuum switch with control rheostat. This circuit provides accurate low-voltage sensing at a level determined by the rheostat setting, together with an inherent time delay, which allows for transient voltage drops and eliminates the contact chatter that might be experienced with a conventional voltage sensitive delay. On mains restoration this delay characteristic prevents transient restoration of mains supply; the main contactors transfer load back to the mains when reasonable continuity of supply can be assured. A similar arrangement is incorporated on the generator side to prevent load being applied to the machine until full voltage is being generated, the time delay allowing also for the inherent characteristic of modern small alternators building up voltage at low speed.

The "Sicon" control panel is designed so that a standard frame size is used for a range of duties from 60A to 220A, the relay arrangements being common throughout the range, changes being made only in the contactor and circuit breaker ratings.

[Reply Card No. E9432]

SHORTER REPORTS *(Continued)*

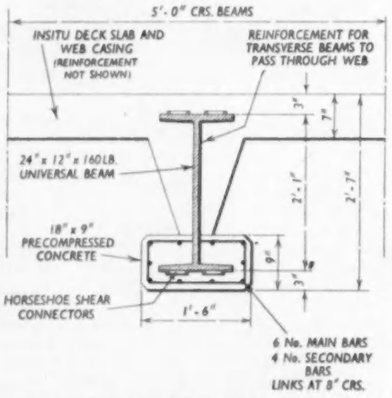




(Left) "Preflex" beams in position, showing the horseshoe connectors welded to the top flanges to resist horizontal shear force set up between the steel joist and the *in situ* concrete casing still to be constructed: similar connectors are provided on the bottom flange. (Right) A pair of 98ft beams, each 40in deep, in position for "Preflexing." Their ends are pulled together by the jacking arrangement shown on the extreme left. Identical equipment operates simultaneously at the end not visible. The beams are then clamped in this position and removed to a frame where the tension flanges are encased in concrete

Composite Construction Using High-Tensile Steel "H"-Beams

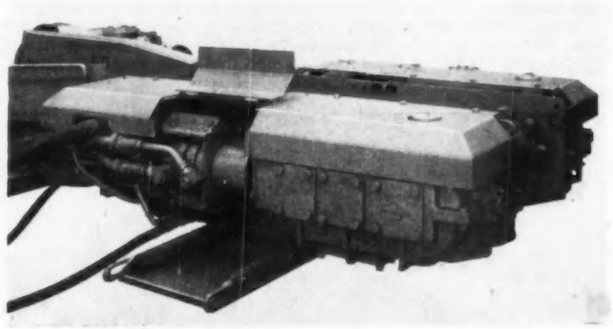
A METHOD of composite steel and concrete construction which aims at utilising to the full the higher stresses permissible in high-tensile steel broad-flanged beams is now being used in this country by Boulton and Paul, Ltd. The method has been used quite extensively on the Continent for several years. It is known as "Preflex" and consists basically of subjecting a broad-flanged beam to a bending moment which induces stresses in it which are somewhat in excess of the working stress (a typical rig for "Preflexing" is illustrated), then casting a concrete casing around the tension flange of the beam. The concrete is of high quality and is reinforced, and there are shear connectors on the tension flange. When the concrete has matured, the beam is released, and is thus "preflexed" by the stresses induced in the concrete casing. Creep and shrinkage losses then eventually give "preflexed" stresses equivalent to the working stress; at "preflexing" a stress of 0·8 that of the yield stress (the yield stress is 22·8 tons per square inch) is induced, the eventual working stress being about 0·72 of the yield stress.



Typical section through bridge beam to span 61ft Ministry of Transport loading

Limiting factors in the use of high-tensile steel beams have tended to be (*a*) stiffness, with too large deflections at the permitted working stress; and (*b*) lateral instability. The "Preflex" method aims at overcoming these drawbacks, and by virtue of the prestressing operation giving an encasement of the tension flange which is not cracked under working loads. The field of applicability of the method is considered to be where conditions tend towards high loading, long spans, and small depths of construction. Very slender spans are practicable with the method, which is not limited to simply-supported spans. The "Preflex" beams are straightforward to handle, and are often incorporated in a further stage of composite construction, using concrete for the floor slab and/or a compression flange, as shown in the accompanying illustrations. In such cases all formwork is carried by the "Preflex" beams.

[Reply Card No. E9441]



60 h.p. hydraulic drive on conveyor head

Hydraulic Drive for Mine Conveyors

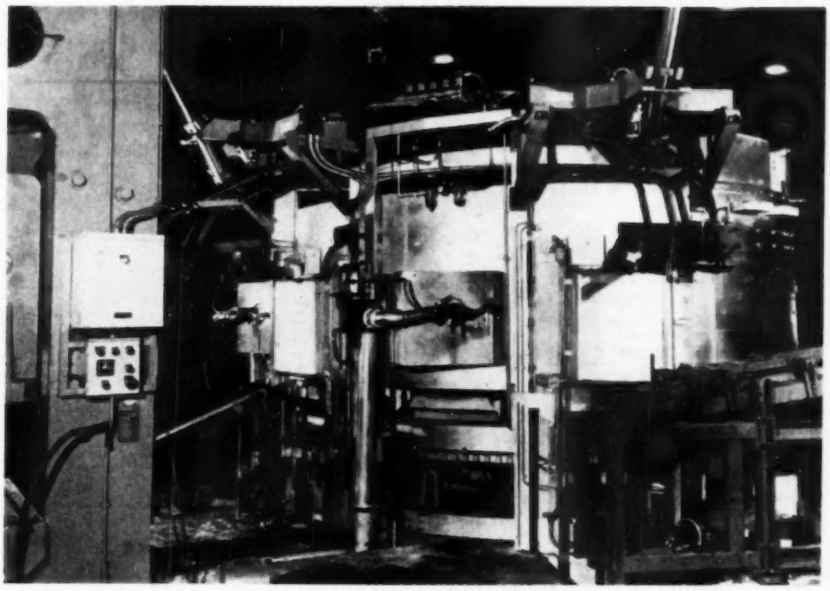
SOME ten years ago a conventional 25 h.p. face belt drive head in a coal-mine conveyor system was converted to a hydraulic drive by Richard Sutcliffe, Ltd., of Harburg, Wakefield, and since that time a number of these "Armadillo" hydraulic drives have been installed. More recently the firm has developed large horsepower hydrostatic units in which the pump and motor are connected by long pipelines: a stop/start and reversing valve fitted on the pressure and exhaust lines connecting the pump and motor enables the motor to be stopped or reversed without stopping the prime mover.

Our illustration shows one of the latest "Armadillo" 60 h.p. drives on the side of a conveyor head; alternatively, two of these drives can be fitted, one on each side of a head. In this installation the pumping set is separated from the driving head by 100 yards of piping. Four pump units are used to drive the one hydraulic motor at the head: the output of pairs of these pumps is delivered into the feed line to compress the oil in two stages. With this arrangement the hydraulic motor can be driven to give two conveyor speeds of 62ft and 125ft per minute.

The power pack includes a 250-gallon tank mounted on wheels on the mine tub track and two bogies, one in front and the other behind the tank, carry the pump assemblies. Each of the twin pump assemblies on the two bogies has an output of 28 g.p.m. and is driven by a 90 h.p. motor.

The maker states that this form of hydraulic drive is more economic than a compressed air drive, which provides the alternative source of power for a coal face when electric power cannot be used owing to gassy conditions. It is quiet in operation and does not produce exhaust vapours whilst, when required, the conveyor can be halted within 2ft of travel.

[Reply Card No. E9442]



Billet loading and unloading equipment for rotary hearth furnace

Billet Handling Equipment for Rotary Hearth Furnace

STEEL billets are charged into a rotary hearth furnace and withdrawn after heating to forging temperature by automatic equipment designed and built by the Hymatic Engineering Company, Ltd., Redditch. The equipment is fitted to a furnace built by the Franklin Furnace Company, Ltd., Baker Street, Birmingham, 11, and used by Smith's Stamping Works, Ltd., Coventry. It handles billets from 3½in to 6in square, up to 18in long, and weighing from 30 lb to 104 lb each, the maximum throughput being 35 cwt per hour.

The furnace is oil fired, with tangential burners, and operates at temperatures up to 1300 deg. Cent., temperature control being automatic. A ratchet and pawl mechanism rotates the hearth under the control of the Hymatic equipment.

Cold billets arrive at the loading point on a gravity conveyor. Here they are "metered," one at a time, to a pneumatic lifting device and raised to the gripping jaws of the pneumatic loader. Interlocking at the billet lift point ensures that only one billet can be loaded at a time, and that loading can only take place when the mechanism is ready. As soon as the billet is gripped by the loader jaws the lifter descends to its rest position, ready to receive the next billet.

The actual loading cycle is initiated by the timer controlling the furnace operation rate. This causes the doors at the loading and unloading points to open, which they do downwards, in order to give a clear space for the operation of the loading and unloading equipment. When the doors are fully open the loader swings inwards to deposit the billet on the hearth. Simultaneously the unloader extracts a heated billet. Both devices then withdraw to their outer positions, the furnace doors reclose, and the hearth indexes one stroke. When the unloader is fully withdrawn the jaws open and allow the hot billet to fall to a chute for transfer to the forging hammer or press.

A.C. Drives for Two Bascule Bridges

THE motor drives operating two bascule bridges in Chatham Dockyard were recently converted from d.c. to a.c. working by Crompton Parkinson, Ltd., Aldwych, London, W.C.2. The two bridges, one of which is illustrated here, are forty years old and they span narrow waterways between basins 1 and 2, and 3 and 4, respectively, of the dockyard.

Both bridges are identical, with a span of 86ft 6in and are wide enough for motor traffic with a catwalk on each side. Each leaf, from its tip to the point of contact with the actuating rack, is about 51ft long. Movement of each leaf was, formerly, derived from a 5 h.p., d.c. motor, installed when the bridges were built. The general condition of the mechanism, after forty years' service was such as to accentuate the original lack of synchronisation between the associated pairs of leaves. Each leaf had to be operated individually from its own control house and the motors could not consistently provide alignment between the leaves in the lowered position, when strict alignment was necessary to allow the locking bolts to be shot. A preliminary survey of the installation suggested that the drive for each leaf required an additional 2½ h.p. Accordingly, the new motors are of 7½ h.p. rating at 710 r.p.m. They are "KRN" totally-enclosed, fan-cooled, weatherproof, slip-ring machines.

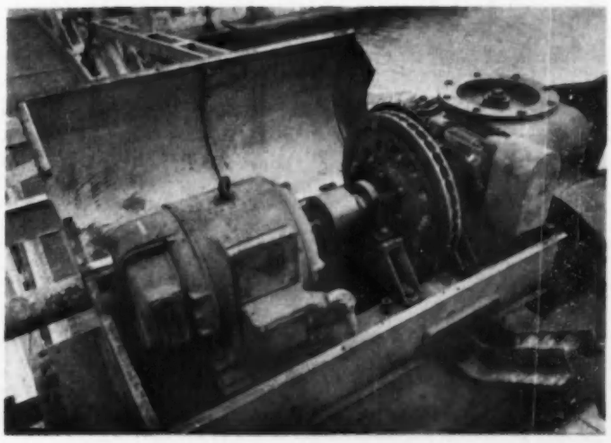
Lack of rigidity on the old drives had resulted in broken shafts on the d.c. motors. Therefore the new motors, complete with transmission systems consisting of flexible couplings and electromagnetic brakes, were mounted on special heavy bedplates and were lined up before dispatch for installation on site as a self-contained assembly as illustrated here.

There is a control house on each side of the waterway and a cable connection through a tunnel enables both leaves to be operated from either one of the control houses. The tunnel is liable to flooding and the cable is a 7/·029, v.r. insulated Derby cable.

Both leaves of a bridge are self-aligning, but if perfect alignment is not achieved, it is possible to make the necessary small adjustments through inching push buttons at the bridge centres. The bridges are fully interlocked with boom gates at either end, and with locking bolts in the centre of each bridge; these bolts are hand operated from the catwalk through crown and worm-wheels. The bridge, therefore, will not rise until the bolts are withdrawn and the boom gates closed to traffic.

The contractor for all mechanical and electrical work, except the running of conduit, was Murray Munro and Co., Ltd., of London.

One of two bascule bridges in Chatham Dockyard; the drives to the leaves have been modernised and converted from d.c. to a.c.



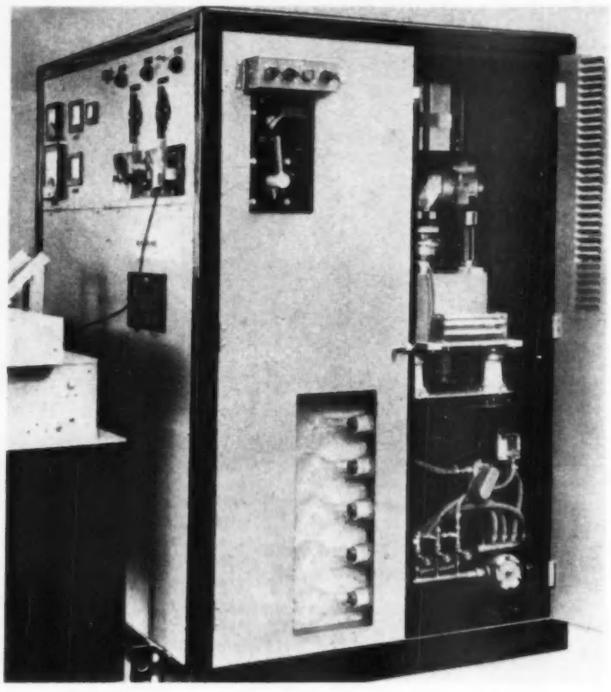
Motor, slipping coupling, magnetic brake with combined flexible coupling and gearing on the leaf of one bridge. Each leaf is separately motor driven and controlled from either of two control houses with full interlocking between bridge and boom gates

SHORTER REPORTS *(Continued)*

Vapour-Cooled Valves for Industrial Heaters

IMPROVEMENTS in valve design have made the valve oscillator a practicable alternative to the motor-alternator for operating induction heaters in the frequency range 1 to 10 kc/s. The induction heater illustrated is a 50kW addition to the range of Radio Heaters, Ltd., and incorporates a BV1121 vapour-cooled triode oscillator made by the English Electric Valve Company, Ltd., Chelmsford, Essex. Vapour-cooling avoids the cost of air filtration necessary when air-cooled valves are used for induction heating in polluted atmospheres such as foundries and forge shops. The valve anode is hermetically sealed in the tank seen inside the cubicle, which incorporates both the boiler and the condenser of the vapour cooling system. Distilled water is used in the boiler to prevent the formation of scale on the valve anode. Heat generated at the anode boils the water at atmospheric pressure, and the heat is extracted from the steam by the condenser. A micro-switch protective device seen above the tank on the right is actuated by the vertical operating rods in the event of low water level or high steam pressure. The glass envelope of the valve is outside the tank and the filament end, at the top, is cooled by a motor-blower, which is visible together with the air delivery duct. A similar system incorporating two English Electric BV1102 valves is used in the 100kW " Radyne " equipment of Radio Heaters, Ltd. This arrangement is particularly suitable for industrial heaters when the small quantity of water required to cool the the work coils can also be used to extract the heat from the condenser.

[Reply Card No. E9461]



50kW induction heater with vapour-cooled valve oscillator

Variable Speed Aggregate Blender

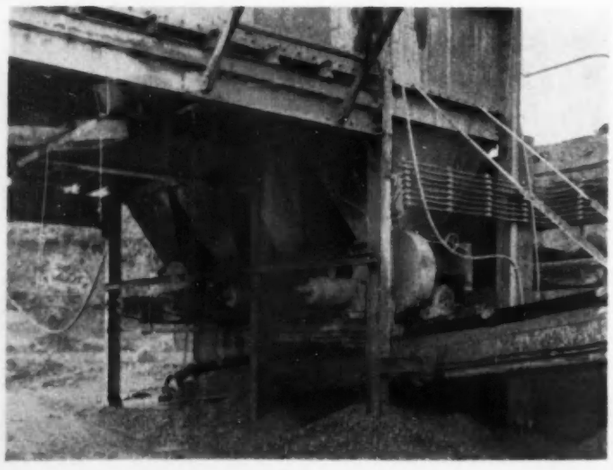
VARIABLE speed motors with remote speed control dials have been introduced into the volumetric feeder system made by Frederick Parker, Ltd., of Leicester, for blending aggregates. These " Blender " equipments, one of which is shown in operation on this page, employ the natural fall of material through an adjustable gate. The flow is controlled by rotating paddles and the equipments are used to supply continuous feed or intermittent batches of material. Batches can be proportioned to any required specification to an average accuracy of 2 per cent. The blending feed units are mounted singly or in banks, as shown, beneath or on the side of aggregate storage bins. Combinations of speed and door settings provide a range of outputs from 5 to 200 tons an hour from one installation.

Until the introduction of the variable speed drive the two basic " Blender " equipments made by the firm used the graded feed system—with fixed speed drive and time control—and a system with hand changed four-speed drive and time control. The variable speed drive with remote control is a development of the speed change design and it eliminates the need for resetting doors for specification changes whilst allowing fingertip control from a remote desk. This desk contains a speed indicator dial (0–100 r.p.m.) for each rotating paddle unit ; a preset dial (0 to 100 per cent in 1 per cent graduations) ; a selector switch for each feeder ; and a preset operation timer.

When installed, all the doors are set so that a similar tonnage passes from each in a given period and they are not disturbed after this. To prepare a batch, the operator turns the presetting dials on the control panel to the percentage required from each feeder.

When the start button is then depressed all the feeders start to run concurrently and at their different speeds, delivering a proportion of the total batch over the same period ; at the end of this set time the feeders stop simultaneously. Specification changes are made by changing percentage readings on the preset dials and batch volumes are altered by increasing or reducing the delivery time.

[Reply Card No. E9462]



Bank of four variable speed blender units in operation

Compressed Air Filters

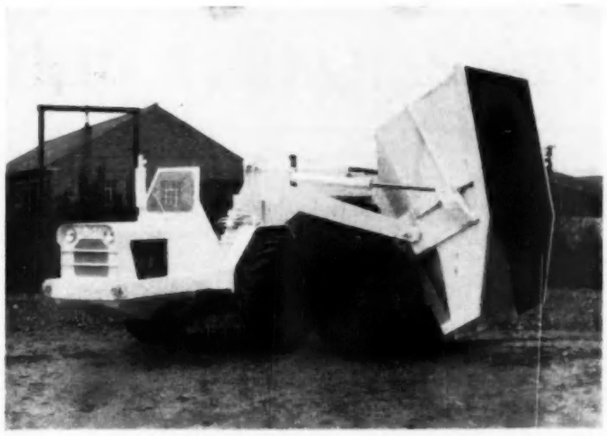
ACTIVATED charcoal filters for the removal of oil in compressed air systems are now made in five sizes with capacities of 3 to 120 cubic feet per minute by Alfred Bullows and Sons, Ltd., Long Street, Walsall, Staffs. These units use expendable cartridges of activated charcoal which are changed at intervals depending upon operating conditions—the average life of a cartridge being between 1000 and 1500 working hours.

The filters are arranged for wall mounting,

Compressed air filter with renewable activated charcoal cartridge

as can be seen in our illustration, and the casings have the air inlets located in the bottom with the outlets at the side towards the top. With this arrangement it is not necessary to break the air connections when changing cartridges.

[Reply Card No. E9463]



7 cubic yard capacity dump truck with a payload of 20,000 lb

Articulated Dump Truck

A 7 CUBIC YARD capacity articulated dump truck with a payload of 20,000 lb which is illustrated on this page is now being made by the Camill Engineering Company, Ltd., of Winchester, and marketed by E. Boydell and Co., Ltd., Old Trafford, Manchester. The individual tractor and dumper body units are linked together by a horizontal pivot, king post and "wishbone" assembly which allows lateral articulation up to 20 deg. between the two units on either side of the vertical plane and a steering movement of 180 deg. about the wishbone centre.

The dumper body is supported on large pivot pins at the wishbone ends and connected to the central structure by two double-acting hydraulic rams which are used to tip the body to its discharge angle of 55 deg. Tipping of the body can be effected when the machine is stationary, travelling or turning.

The tractor is powered by a Fordson "Power Major" diesel engine developing 52 b.h.p. at 1600 r.p.m. and a maximum torque of 171 lb feet at 1200 r.p.m. Power is transmitted through a dry plate clutch to a constant mesh gearbox providing six forward speeds from 2 to 13 m.p.h. and two reverse speeds of 2·75 and 5·0 m.p.h. The semi-floating design driving axle is solidly mounted on the frame. The rear wheels are fitted with Dunlop hydraulic disc brakes with vacuum servo boost and the front brakes are of hydraulically operated disc design.

To provide light and sensitive steering under all ground conditions a direct mechanical linkage is hydraulically boosted through four double-acting hydraulic rams. A damaged ram in the steering system can be quickly isolated with only a proportionate loss of power and, in the event of the complete failure of the hydraulic system, the mechanical linkage provides limited steering power. The control pedal arrangement follows standard automotive practice but separate pedals are provided to operate the brakes on all four wheels or on the rear wheels only. A hand-operated, multi-disc transmission parking brake acts on the front driving wheels only.

The maker states that, should the dumper become bogged down on soft ground, it can extricate itself unaided by a "jack-knifing" operation using the power of the tipping rams and the brakes alternately.

[Reply Card No. E9471]

"Ladder" Drilling for Rock Tunnelling

EQUIPMENT newly introduced to this country by Atlas Copco, Ltd., is intended to improve performance and economy in driving rock tunnels, and is known as the "ladder" drilling technique. The ladders are simply what their name implies, being made from steel angles and rungs. The normal rock drill is supported on a ladder, by a sliding cradle guided by two "runner" bars welded to the ladder, and the airleg is extended in line with the drill, which it pushes forward by bearing against one of the rungs at the rear. The ladder thus serves to support the drill, and to align it so that the hole is accurately drilled. A lug welded on the leg permits it to grip the rungs in either direction, so when the drill steel has to be changed, power retraction along the ladder is simply effected. "Collaring" at the rock face is also facilitated by an attachment which is illustrated, together with a typical method of mounting "ladders" in a drilling jumbo, each ladder being carried on two pivoted arms. Clearly many variants in the method of mounting the ladders are possible, the simplest being a ladder resting on the floor of the tunnel, and adjusted by inclined legs mounted at each end of it. At a tunnel of the Swedish Power Board where this method was investigated, the mountings shown in the illustration were in use, but the upper ladders were mounted on a frame which could be raised hydraulically.

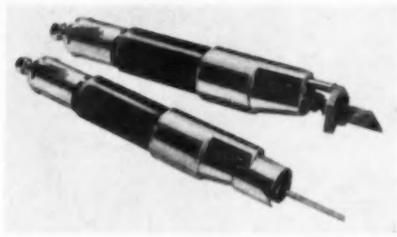
Drillsteel support of the "ladder" drilling rig

Advantages claimed for the method are (*a*) that accuracy in drilling is ensured and (*b*) improvements in speed and cost. The former tends to favour longer "pulls." The latter depends on the use of longer drill steels and easier changing of them due to the power retraction mentioned above; a general reduction in manual effort due largely to the fact that the drills are supported; and on the fact that one man can control two drills. The flexibility of the technique is also stressed.

[Reply Card No. E9472]

Pneumatic Sawing or Filing Tool

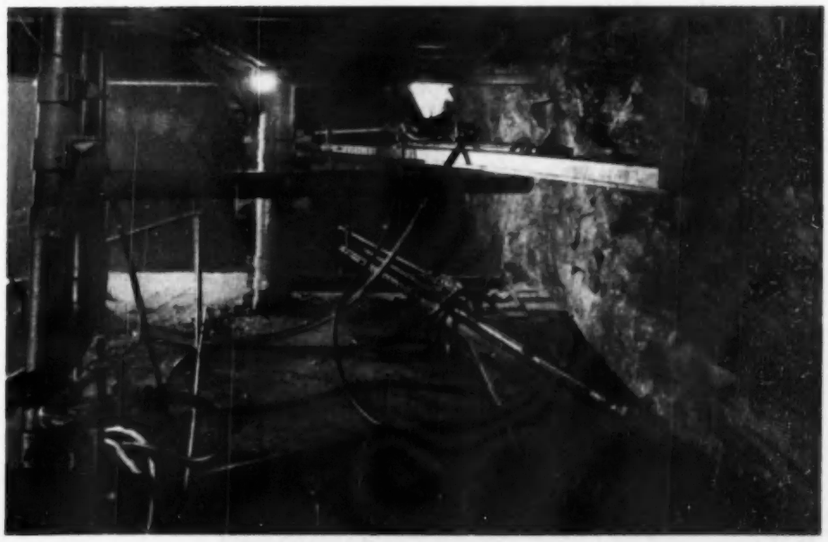
A PORTABLE air-driven hand tool which can be fitted with a collet to take a saw blade or a chuck to take a file, as shown in our illustration, has been introduced by the Consolidated Pneumatic Tool Company, Ltd., 232, Dawes Road, London, S.W.6. In the tool the rotation of a vane design air motor is converted to a reciprocating motion by a cam: the speed is adjustable up to 1500 strokes a minute, the length of stroke being fixed at $\frac{1}{4}$in. The flow of exhaust air is directed down through the nose of the tool to blow the cuttings clear of the workpiece.



Air-driven hand tool with interchangeable collets to take a saw or file

The tool, which weighs some 5 lb and has an overall length of 14$\frac{1}{2}$in, is designed to be held easily in the hand to cut or file at any angle. An oil reservoir built into the handle supplies lubricant to the motor whilst it is running.

[Reply Card No. E9473]



"Ladders" mounted on fore and aft beams. The "ladders" can be swung through an arc and the flexibility of the system can be seen

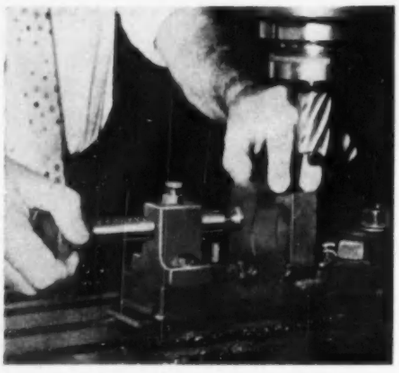
SHORTER REPORTS *(Continued)*

Ratchet Piston Clamp

A RATCHET piston clamping device, now being made in two sizes, by Speed Tools, Ltd., Vereker House, Gresse Street, London, W.1, is intended for use wherever fast clamping is required together with a straight push action on to the work to be held. It can also be used to clamp through holes, into deep recesses or over lips and obstructions.

These ratchet piston clamps combine screw operation with instantaneous coarse adjustment. Coarse adjustment is provided by ratchet teeth spaced $\frac{1}{16}$in apart along the barrel and fine adjustment is effected by the screw which has a movement of $\frac{1}{4}$in in the barrel.

In practice, after loading a workpiece into a simple jig, as shown in the illustration, the piston



Applying pressure on to a component in a fixture by fine screw adjustment of the ratchet piston clamp

is thrust forward on to the component, and final adjustment and clamping is effected by a quick turn of the large diameter handwheel, usually by not more than three turns.

The barrel of the clamp can be released by pinching and lifting a spring pawl on top of the body casting after slightly unwinding the handwheel, the barrel can then be pushed back as far as desired to remove the workpiece.

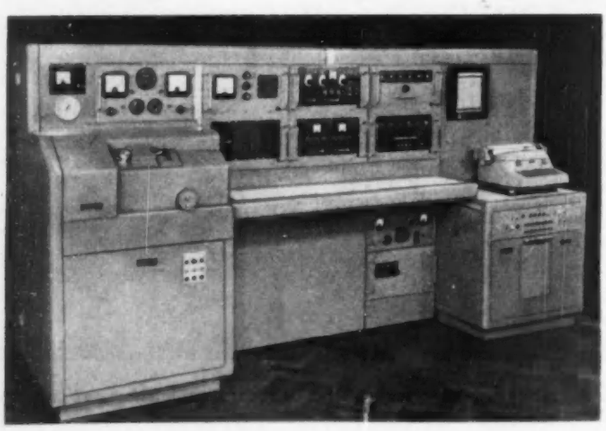
[Reply Card No. E9481]

Automatic X-Ray Spectrometer

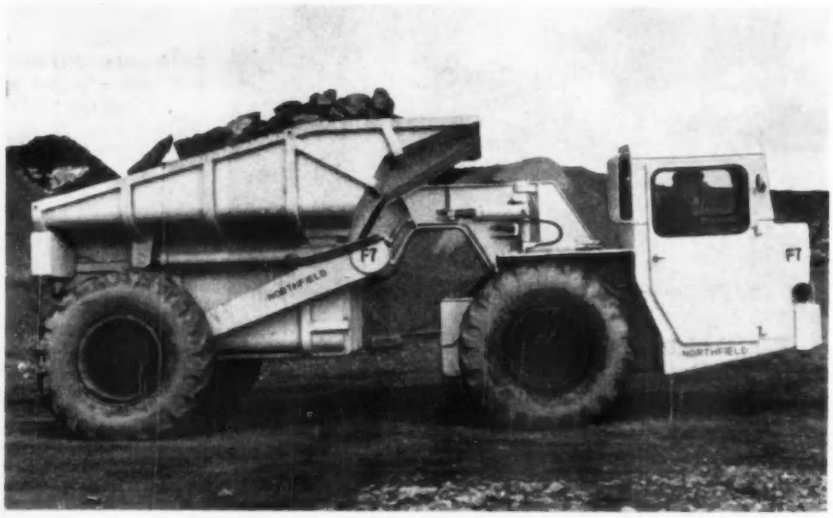
X-RAY fluorescence spectroscopy is becoming established as a tool for routine process control, and for this reason the range of spectrometers produced by Hilger and Watts, Ltd., 98, St. Pancras Way, Camden Road, London, N.W.1, now includes the automatic " Fluroprint " instrument illustrated. This has been developed primarily for routine production control, with printed record of results, where large numbers of samples have to be analysed. Analytical programmes can be changed simply by substitution of different plugboards in the receptacle below the typewriter at the right-hand end of the console.

The process of X-ray fluorescence spectroscopy makes use of the secondary fluorescent radiation produced when a specimen is bombarded by hard X-radiation. This secondary radiation has wavelengths characteristic of the elements in the sample. The fluorescent radiation is collinated by a set of vertical parallel foils, which limit the divergence of the beam, and falls on the analysing crystal. This is a single crystal with crystallographic planes parallel to its surface. For any particular position of the crystal relative to the beam, only a few discrete wavelengths are reflected and enter the detector. The crystal and detector are rotated together, the angle between them being maintained constant, and are programmed to stop at the appropriate positions for each element. At each position the pulses from the detector (a scintillation counter or flow proportional counter) are counted during the accumulation of a preset number of counts on a monitor, and the result is printed out on an electric typewriter giving a measure of the line intensities, and hence of percentage content in the sample of the various elements. The " Fluroprint " will deal with any element having an atomic number of 12 (magnesium) or higher, and will analyse up to twenty elements in one operation. The spectrometer is completely evacuated to eliminate air absorption in the path between the sample and the counter.

[Reply Card No. E9482]



X-ray fluorescence spectrometer with automatic scanning and print-out of results



Short wheelbase 7½ cubic yard dumper

7½ Cubic Yard Dumper

THE 7½ cubic yard capacity dumper with a payload of 25,000 lb shown in the illustration below has been developed by Northfield Industrial Fabrications, Ltd., Langley Mill Works, Ossett, Yorks. It is powered by either a Ford 96 b.h.p. or a Perkins 115 b.h.p. oil engine and the drive is transmitted through a Brockhouse torque converter giving an automatic gear ratio between 6·54 and 1 to 1 in two forward speeds with an overall reduction of between 121 and 19·5 to 1 through the final drive. The weight distribution is so arranged that a minimum of 55 per cent is always imparted on the front driving and steering wheels, whether the hopper is loaded or empty.

The power-operated steering facilitates manoeuvring and the dumper has a turning cycle of 18ft 9in—less than its overall length. Hydraulic power for steering, tipping and disc brakes on the transmission is supplied by a pump driven from the power take-off of the torque converter. The oil used for final drive lubrication also feeds the hydraulic system and is the same grade as that used in the engine.

[Reply Card No. E9483]

Launches and Trial Trips

NOTRE DAME D'AFRIQUE, cargo ship ; built by the Anciens Chantiers Dubigeon for Schiaffino-Algiers ; length between perpendiculars 301ft 9in, breadth moulded 47ft 4in, depth to upper deck 28ft 7in, draught 22ft 8in, deadweight 3500 tons ; two decks, three holds, one 25-ton, two 10-ton and eight 5-ton derricks ; three 180kW diesel-driven generators ; two S.E.M.T.-Pielstick 9.PCL, single-acting, four-stroke, supercharged diesel engines, 5760 h.p. at 420 r.p.m., drive single shaft at 220 r.p.m. through reduction gearing, trial speed 19·4 knots. Trial, August.

TEXACO OSLO, oil tanker ; built by the Blythswood Shipbuilding Company, Ltd., for the Texas Company (Norway) A/S ; length between perpendiculars 535ft, breadth 71ft 8in, depth moulded 39ft 8in, draught 30ft 8in, deadweight 18,810 tons ; loaded trial speed 15½ knots ; thirty cargo oil tanks, two pump rooms, four 500 tons per hour vertical compound cargo pumps, one 300 tons per hour lubricating oil pump, one 150 tons per hour petro-chemicals pump ; two 280kW diesel-driven generators, one 150kW steam-driven generator ; Rowan-Doxford, six cylinders, 650mm diameter by 2320mm combined stroke, 8800 b.h.p. Trial, August 11.

INDUSTRIAL NEWS

Shipbuilding Wages

On Thursday of last week the Shipbuilding Employers' Federation rejected a claim for increased wages for shipyard workers which had been submitted to it on September 29 by the Confederation of Shipbuilding and Engineering Unions (THE ENGINEER, October 7, 1960).

Mr. John Rannie, president of the Federation, pointed out that only by cutting costs instead of increasing them could it ensure the industry's future and try to halt the unemployment in shipbuilding and ship-repairing establishments which was already showing itself, and which would become progressively worse during the next few months unless further orders could be obtained. At the end of September the industry's order book showed contracts for just under 3,500,000 tons valued at £525 million. Almost 48 per cent of that tonnage was on the berth or fitting out, and some of it had been delivered since. The balance included contracts which had been postponed, in some cases indefinitely. A number of shipyards, Mr. Rannie added, had already launched their last ship and had no new keels to lay down ; others were building their last ship with no further orders to follow.

Continuing his detailed reply on behalf of the employers, Mr. Rannie said that the agreement earlier this year on reduced hours was reached on the basis that none of its employees would suffer a reduction in wages and had directly resulted in the hourly earnings being increased by 4¾ per cent. The average earnings of all adult men in April, 1960, were 280s. 9d. for 46·2 working hours, compared with 267s. 2d. for 47·1 hours in the last pay week in October, 1958. The employers had made a special inquiry into earnings in the industry, related to a typical week in October this year, which disclosed, Mr. Rannie said, that the average earnings for all adult male employees were 288s. 5d. That rise, he continued, had been achieved despite a fall of half an hour in the average hours worked. That the reduction in hours worked should be a small one confirmed the Federation's earlier fear, Mr. Rannie said, that the main result of a lowering of hours of the working week would be an increase in the number of hours paid for at premium rates.

In conclusion, Mr. Rannie said that the Confederation officials had spoken about misleading reports in newspapers which suggested that workers had resisted changes in methods of production. "We (the Federation) can only say once more," Mr. Rannie added, "that while many of your members have co-operated in such changes, there are large numbers who have not done so but indeed have given every indication of resisting them."

Overseas Trade

Final figures issued by the Board of Trade for United Kingdom trade in October show that exports were valued at £257,200,000, imports at £378,600,000, and re-exports at £12,100,000. These figures, the Board points out, are affected by the strike of tally clerks at the London docks in September and October. Experience during and after previous strikes, the Board says, suggests that a stoppage in the last week or two of any month is reflected only to a small extent in the export figures for that month but to a larger extent in the import figures. Most of the immediate effects on exports of the delays in shipping probably fell on the October figures, whereas part of the effect on imports was reflected in the September figures. More of the clearance of delayed goods in October would, however, be reflected in the import figures than in the export figures.

Compared with the previous few months, the Board suggests, the strike could be held responsible for the low level of recorded exports in October, but at the same time it points out that but for the strike, recorded imports would also have been larger. Some of the back log is unlikely to be worked off for some months, particularly in trade with ports which may be closed by ice in the winter months, and some export orders, the Board feels, particularly orders for the Christmas trade, must have been lost permanently.

The delays affected trade with individual areas and countries and in the various classes of commodities to a varying extent, the Board says. There was most delay in the "ocean trade" and this seems to be reflected in particularly low figures for trade with the overseas sterling area in October.

Iron Castings

The total output of iron castings in the third quarter of 1960 was 903,700 tons, according to the latest figures published by the Joint Iron Council. Production in the third quarter of a year should not be compared with production in any of the other three quarters because holidays are taken during those three months. But compared with preceding years, output in the third quarter of 1960 was a record. The figure for the third quarter of 1959 was 802,200 tons.

The number of people employed in the ironfounding industry at the end of September, 1960, was 131,000, the Council states. This is 1400 more than three months ago and 6400 more than at the end of September, 1959.

Engineering Wages

At a special conference held on Wednesday of last week, the Engineering and Allied Employers' National Federation made its reply to the claim of the Confederation of Shipbuilding and Engineering Unions for an increase of £1 a week for engineering workers. Mr. F. Vincent Everard, president of the Federation, on behalf of the employers offered increases in the consolidated time rates as follows : for the skilled grades 6s. per week ; for the intermediate grades 5s. 6d. per week ; for labourers 5s. per week, and for women of eighteen years of age and over 4s. 6d. per week. There would, he added, be the usual related increases for younger females and for apprentices and for boys and youths. The date of operation would be January 1, 1961, in view of the fact that the last national agreement reducing the working week by two hours operated from as recently as the end of March last.

Mr. W. J. Carron, replying on behalf of the unions, said that he was quite sure that he would be reflecting the thoughts of his colleagues if he said that he did not think they would be disposed to consider those figures at all. After further discussion, Mr. Everard, on behalf of the employers, said that, with very great misgivings and reluctance, they were prepared to increase the offer in each grade by 1s. Mr. Carron replied that his impression was that his colleagues would still feel that the offer was very low. The unions retired to consider the offer and on their return Mr. Carron, on behalf of the the Confederation, stated that the offer was unacceptable both in amount and in date of operation.

English Electric and the G.E.C.

A joint statement by The English Electric Company, Ltd. and The General Electric Company, Ltd., issued on November 29 announced that the two companies had been unable to bring their talks on a proposed merger (THE ENGINEER, September 30, page 566) to a successful conclusion and that negotiations had been discontinued.

Tally Clerks' Strike

The committee of inquiry appointed by the Minister of Labour to examine circumstances under which tally clerks at the London Docks went on unofficial strike from September 20 to October 17 has published its report. The unofficial strike which caused such extensive damage to the economic life of the port and of the country, the report states, was a strike against a decision of the London Dock Labour Board to invite volunteers from within the industry, with a view to transferring fifty of these applicants to the tally clerks' sub-register. In other words, the report says, the strike was a strike against a proposed adjustment of the register designed to meet a critical situation which had developed in the balance of the port's labour force.

It is regrettable, the report goes on to say, that the tally clerks should evidently have thought they were better placed than the Board to assess requirements of its sub-register. The basic cause of the strike, the Committee suggests, was a desire on the part of the tally clerks to keep for their labour a high scarcity value. But by their resistance to recruitment and by maintaining a scarcity of clerical labour in the ocean trade they have prejudiced the piecework earnings of their fellow dock workers in that trade, to say nothing of prejudicing the export and import trade of the country as a whole. The committee added that it could find little or nothing to say in defence of the conduct of the tally clerks. That they should have persisted in their deplorable conduct for almost two weeks after the Minister of Labour had promised them an investigation, was nothing less than wanton and called for unqualified condemnation.

The Committee also criticised the Board and said that it thought it had been oversensitive to the views of the tally clerks and during that year had tended to do too little too late when increases in the sub-register were clearly required. In marked and happy contrast, however, to the irresponsible conduct of the tally clerks, the Committee stated that it had been greatly impressed by the high sense of responsibility and moral courage displayed by the unions.

PERSONAL AND BUSINESS

Appointments

MR. PETER NEVEN has been appointed chief consultant to Wellson Abrasive Products, Ltd.

J. I. CASE COMPANY, Ltd., has announced the promotion of Mr. Harry Bray to inspector for the company.

THE MINISTRY OF AVIATION announces that Mr. F. E. McGinnety has been appointed its director-general of inspection.

MR. E. V. BEATSON, of Joseph Lucas, Ltd., has been appointed by the Council of the British Welding Research Association to serve on the Association's Research Board.

REAR-ADMIRAL A. J. Tyndale-Biscoe, M.I.Mech.E., F.R.Ae.S., has been elected to the board of directors of Blaw Knox, Ltd., and appointed assistant managing director.

DOWTY GROUP, Ltd., announces that Mr. H. L. Sharp, previously director and general manager, has been appointed managing director of New Mendip Engineering, Ltd.

THE MINISTRY OF AVIATION announces that Mr. L. R. Beesly has been appointed director-general of aircraft production. He will begin his new duties on December 1, 1960.

MR. C. G. LLOYD, formerly sales office manager of Steel Fabricators (Cardiff), Ltd., has been appointed sales manager of the company's agricultural and industrial sales divisions.

MR. E. B. THOMPSON, sales manager, Ekco Electronics, Ltd., has been elected chairman of the Nucleonics Group of the Scientific Instrument Manufacturers' Association.

MR. HARRY WEST, managing director of Associated Electrical Industries (Manchester), Ltd., has been appointed to the board of Associated Electrical Industries, Ltd., with effect from January 1, 1961.

THE ROYAL SOCIETY has appointed Mr. W. J. Darcey of the University of Melbourne to be Rutherford Scholar for 1960 for three years to carry out research in experimental nuclear physics at the Clarendon Laboratory, Oxford.

WESTINGHOUSE BRAKE AND SIGNAL COMPANY, Ltd., has announced that following the retirement of Mr. A. V. Hichisson, Mr. J. Hounsell has been appointed publicity manager. Mr. A. A. Rhodes has been appointed deputy publicity manager.

THE BRITISH BROADCASTING CORPORATION states that Mr. J. D. MacEwan, A.M.I.E.E., has been appointed as engineer-in-charge, television, Birmingham, in succession to Mr. H. G. Whiting, A.M.I.E.E., who recently became regional engineer, Midland region.

THE GENERAL ELECTRIC COMPANY, Ltd., states that Mr. Arnold Lindley, vice-chairman and managing director, has been elected chairman of the company, to succeed Sir Leslie Gamage on his retirement at the end of the year. Mr. Lindley will continue as managing director.

THE MINISTRY OF HOUSING AND LOCAL GOVERNMENT announces that Mr. E. H. Browne, deputy chairman, National Coal Board, Mr. W. L. Mather, chairman, Mather and Platt, Ltd., and Mrs. Winifred Shutt, Alderman, City of Leeds, have been appointed to be members of the Clean Air Council until April 30, 1963.

RICHARD THOMAS AND BALDWINS, Ltd., announces that Mr. J. T. Mills has been appointed chief engineer at Ebbw Vale Works. He has been succeeded as chief electrical engineer by Mr. A. W. Ellis. The new deputy chief electrical engineer is Mr. T. Lloyd. Following the death of Mr. F. E. C. Probyn, Mr. E. W. Smallman has been appointed chief mechanical engineer.

TUBE INVESTMENTS, Ltd., announces that Sir William Strath has been appointed to the board with effect from January 1, 1961. Sir William will also be joining the board of the British Aluminium Company, Ltd., and will become managing director. Lord Plowden, at present chairman and managing director of the British Aluminium Company, Ltd., will remain chairman of the company.

MR. ERIC E. JONES, group commercial director of the Solartron Electronic Group, Ltd., is leaving to become managing director of Adrema (Holdings), Ltd., and its subsidiaries, including the Bradma companies. He will at the same time become European vice-president of the Farrington Manufacturing Company, Needham Heights, Massachusetts, U.S.A., the parent company of Adrema (Holdings), Ltd.

INTERNATIONAL COMPUTERS AND TABULATORS, Ltd., announces that following the death of the company's chairman, Sir Cecil Weir, and pending the appointment of a chairman, Mr. H. V. Stammers has been appointed acting chairman. Mr. C. Mead has been appointed to be a deputy chairman, and Mr. J. Bull to be managing director.

THE U.A.M. GROUP has appointed Mr. W. Sylvester to its Birmingham sales area. His territory will be Leicestershire and South Lincolnshire, taking over the duties of Mr. J. M. Horton and Mr. F. Suddards. Mr. Horton takes over the northern part of Staffordshire, including Stoke-on-Trent, from Mr. G. V. Tabner.

ROCKWELL MACHINE TOOL COMPANY, Ltd., Welsh Harp, Edgware Road, London, N.W.2., announces that Mr. F. A. Young, has, on medical advice, relinquished his post as manager of the company's Northern Sales area. Mr. Young will continue to represent the company on a part-time basis in the North Wales Area, to which he has moved. Mr. S. E. Bennett has succeeded Mr. Young as manager of the Northern Area.

Business Announcements

THE HONGKONG ELECTRIC COMPANY, Ltd., states that its address in London is now 40, St. Mary Axe, London, E.C.3 (telephone, Avenue 4680).

THE BRITISH ALUMINIUM COMPANY, Ltd., has opened a district sales office at Swan House, 3, High Street, Bedford (telephone, Bedford 5428).

C. E. JOHANSSON, Ltd., Southfields Road, Dunstable, Beds., announces that on December 8 its telephone number will be changed to Dunstable 62422.

MASSEY-FERGUSON, Ltd., Coventry, has announced that it has purchased the Italian tractor company G. Landini and Figli, S.P.A., which has factories at Como and Fabbrico.

X-RAY ENGINEERING (LONDON), Ltd., has opened a new X-ray laboratory for inspection of plastics at 926, North Circular Road, London, N.W.2 (telephone, Gladstone 1402).

THE ELECTRIC RESISTANCE FURNACE COMPANY, Ltd., Netherby, Queens Road, Weybridge, Surrey, a member of Efco group of companies has changed its name to Efco Furnaces, Ltd.

MR. JOHN HOWARD, joint managing director of Landmaster, Ltd., a member of the Firth Cleveland Group, is flying round the world on a tour of Landmaster licensees, agents and distributors.

ROLATRUC, Ltd., the United Kingdom distributor for the Swedish BT pallet and stacking trucks has moved to larger premises at 207, Hanworth Road, Hounslow, Middlesex (telephone, Hounslow 5875).

SOUND DIFFUSION (AUTO-THERMATIC), Ltd., Portslade, Sussex, has appointed Officine Guardigli, Via A. T. Trivulzio 18, Milano, Italy, to handle the sale and distribution of "Datofonic" equipment throughout Italy.

IMPERIAL CHEMICAL INDUSTRIES, Ltd., Nobel Division Supply Department, 460, Sauchiehall Street, Glasgow, C.2, states that the address of the supply department has been changed to Stevenston, Ayrshire (telephone, Ardrosson/Saltcoats 621).

THE BRITISH SHIPBUILDING RESEARCH ASSOCIATION announces that as from December 12 the Association will move to a new office at Prince Consort House, 27-29, Albert Embankment, London, S.E.11 (telephone, Reliance 6481).

A.L.C.O. PRODUCTS Inc., New York, and DAVEY, PAXMAN AND CO., Ltd., Colchester, have signed a reciprocal agreement under which the two companies have agreed to collaboration on diesel engine design and manufacture of each other's engines for certain world markets. The engine ranges are complementary so that co-operation is not only useful commercially but enables each company to expand its range of engines without incurring high development costs and without the inevitable delay from the drawing-board to the production stage. Both companies manufacture engines for the traction, industrial, marine and oilfield applications. A.L.C.O. Products Inc. (formerly the American Locomotive Company) manufacture diesel engines of 9in bore in six, twelve and sixteen-cylinder units covering the power range from 900 to 3000 b.h.p. The engines also operate as dual fuel engines burning natural gas. In the Paxman range are 7in bore engines and the 7¼in bore "Ventura" unit which range in power from 150 to 2300 b.h.p.

SANDVIK SWEDISH STEELS, Ltd., Halesowen, Birmingham, has opened a new distribution depot at East Kilbride.

ENGINEERING SUPPLIES, Ltd., P.O. Box 44, Jersey, Channel Islands, states that it has acquired the majority of the stock of Associated Tube Wells (International), Ltd., which is being absorbed into its affiliated company Water Development Corporation, Ltd., to form the ground water division of that company.

MR. CHARLES W. HAYWARD, chairman of the Firth Cleveland Group of Companies, will arrive in Colombo on December 17, and will visit India, Thailand, Malaya, Singapore, Hong Kong, Japan, San Francisco, Chicago, New York, and Nassau, in an extended tour in pursuance of the Group's export policy.

THE BRITISH XYLONITE GROUP, composed of BX Plastics, Ltd., Halex, Cascelloid, Scintellex, Expanded Rubber Company, Ltd., Expanded Plastics, Ltd., and Onazote Insulation Company, Ltd., has moved from 9, Conduit Street, W.1, to offices with showrooms at 27, Blandford Street, London, W.1 (telephone, Welbeck 9211).

ENGELHARD HANOVIA LAMPS, a branch of Engelhard Development Company of Canada, Ltd., and the "ALFLOC" WATER TREATMENT SERVICE OF IMPERIAL CHEMICAL INDUSTRIES, Ltd., have concluded an arrangement whereby the latter will undertake sales and technical service in Great Britain and Northern Ireland of Hanovia ultra-violet radiation equipment for the sterilisation of water.

Contracts

THE MIDLAND HEATING AND VENTILATION COMPANY, Ltd., of Birmingham, has received an order from Messrs. Cubitt Fitzpatrick Shand, acting on behalf of the London County Council, for the complete ventilation plant for the Hyde Park Underpass. This plant incorporates eight of the company's "Gyra-Flo" Airfoil fans, and will automatically limit the air contamination in the underpass.

RANSOMES AND RAPIER, Ltd., Waterside Works, Ipswich, has received an order valued at 1,500,000 dollars for the construction of a walking dragline for D. W. and R. A. Mills, Ltd., of Minto, New Brunswick, Canada. The Rapier W1350 machine being supplied to this order weighs 1400 tons and is equipped with a 33 cubic yard capacity bucket capable of carrying 50 tons of material over a radius of 215ft.

THE HEAVY PLANT DIVISION OF ASSOCIATED ELECTRICAL INDUSTRIES, Ltd., has received an order from the General Chemicals Division of Imperial Chemical Industries, Ltd., for germanium rectifiers with a capacity of 32·4MW at 270V, for the electrolytic production of chlorine. These rectifiers will work in parallel with a large number of motor converters and contact rectifiers (also of A.E.I. manufacture).

THE BRITISH TRANSPORT COMMISSION has placed a contract with Simon Handling Engineers, Ltd., for the supply of a floating pneumatic grain elevator, as part of the modernisation scheme in the Port of Hull to enable larger grain ships to be discharged more efficiently and to speed the turn-round of shipping in the King George Dock. The capacity of the elevator will be 300 tons of grain an hour and the value approximately £270,000.

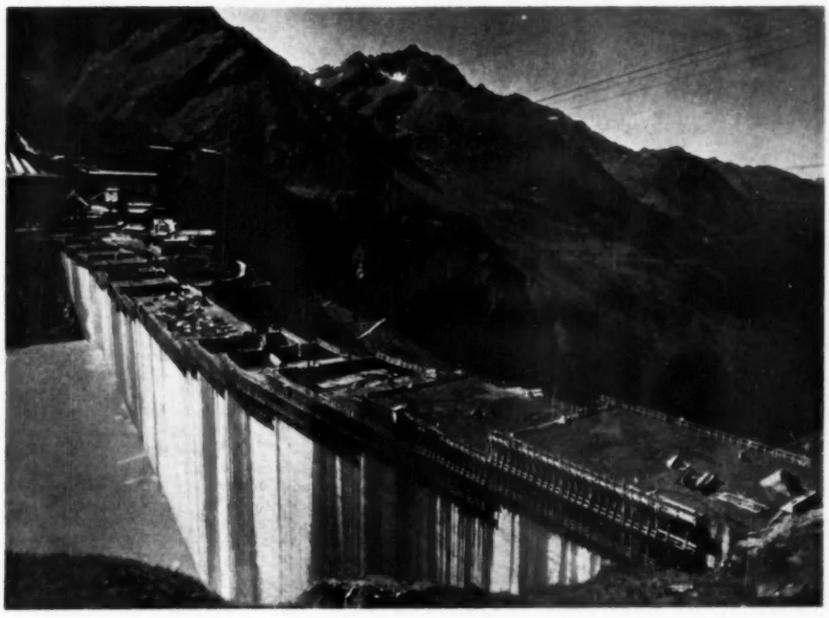
HEAD WRIGHTSON AND CO., Ltd., announces that following a £1,500,000 contract from the Appleby-Frodingham Steel Company (Branch of the United Steel Companies, Ltd.) for sinter machines, its subsidiary Head Wrightson and Co., Ltd., has now received an order for a gas cleaning plant, capable of cleaning 8,100,000 cubic feet per hour of blast-furnace gas. The plant will consist of two, 18ft diameter washers and four 23ft 6in diameter precipitators, together with ancillary equipment and instrumentation. The value of the plant is over £450,000, and it is expected to be completed by the end of 1961.

Miscellanea

LARGE LIGHTWEIGHT GAS TURBINE.—The 1250 h.p. Solar "Saturn" is now available from Perkins Gas Turbines, Ltd., in both fixed-shaft and free-turbine forms. The "Saturn" is an engine of "aircraft" construction, weighing about 950 lb, and accepts peak load within forty seconds from commencing the starting cycle; the cycle maximum temperature is 1500 deg. Fah. and the output speed is remarkably high at 22,000 r.p.m.

CONTINENTAL AFFAIRS

by Our Continental Editor



Grande Dixence Scheme

ON October 29, work was halted for the 1960 season on the Grande Dixence dam, the world's highest dam and one of the world's largest gravity dams, which lies at the foot of the Val des Dix in the Canton of Valais in Switzerland. Two weeks earlier, the dam had already reached its full height of 932ft for part of its crest, and all that remains to be done in 1961 is to complete the top section of the dam over its full length. Thereafter, the constructional equipment will be taken down and the site landscaped to restore its original appearance as far as this is possible. One of the biggest civil engineering operations ever undertaken in Europe will then have come to an end.

The scheme has already been described in an earlier article.* The dam, 2300ft long and 72ft wide at its crest, 650ft wide at its base and containing 7·7 million cubic yards of concrete, will impound a reservoir of 520 million cubic yards capacity which is supplied from a catchment comprising many of the principal glaciers of the Valais and covering about 160 square miles through a complex system of tunnels and aqueducts. The total output capacity of the two power stations at Fionnay and Nendaz will amount to 760MVA, and the annual energy output of the scheme to 1650 million kWh, 85 per cent of which will be produced in the winter. This amounts to almost 10 per cent of the energy produced for the whole of Switzerland.

The works organisation at the relatively remote site is of particular interest. Access is obtained from the nearest railhead at Sion in the Rhône valley 1600ft above sea level, first along a 15-mile public road to Motôt, and then along a private road, which has twenty-four hairpin bends in a total length of 3·4 miles, to the administrative and living quarters at Le Chargeur and the concrete preparation plant at Blava at a height of 7600ft. The road has an average gradient of 1 in 16 and in many places it is barely 10ft wide.

To relieve the road of heavy construction traffic, cement is conveyed from Sion to Blava by two temporary ropeways, 11 miles long with a capacity of 1200 tons each per day ; each bucket carries 880 lb. The ropeways are built in two sections with a transfer station about 5 miles from Sion. Aggregate is taken from glacial moraines 1000ft to 1500ft above Blava ; it is broken down to 5in maximum size in two large rotary mills (capacity 800 tons per hour) and then fed from the aggregate preparation centre at Prafleuri to Blava by a 1 mile long conveyor belt, consisting of six sections, which has a total capacity of 800 cubic yards per hour. A main dump of 170,000 cubic yards serves as a reserve for the start of operations in the spring when ice conditions retard the winning of the aggregate, and there is also a buffer dump of 22,000 cubic metres capacity at Blava.

The aggregate is washed and sorted at Blava, and fed according to size to four silos of 650 cubic yards each (0–3mm) and four silos of 4500 cubic yards (0–3mm, 3–10mm, 10–40mm, and 40–120mm). Cement is discharged at the terminal of the ropeways, buffer storage being provided by two 1000-ton silos. The cement is then pumped to two preparation towers at the rate of 80 tons per hour, aggregate being fed to the towers by conveyor. Each tower contains three mixers of 80 cubic feet each (supplied from Britain) and can produce 160 to 200 cubic yards of concrete per hour. The mixed concrete is tipped into buckets which are conveyed by tractor-driven carriers to the fixed terminals of two 3000ft long Blondin cableways spanning the dam site. There are two buckets on each cableway, each carrying 8 cubic yards (approximately 16 tons), the buckets being directed to the correct position on the dam by telephone. They traverse the dam at about 17ft per second, are then lowered at half this speed and discharged. The two cableways have a movable anchoring point on the right hand side of the valley along a 1200ft curved track with an incline of 35 per cent.

The three principal construction centres of Le Chargeur, Blava and Prafleuri and also the right-hand side of the valley are interconnected be cableways which serve to transport both personnel and equipment. The extent of mechanisation is indicated by power requirements on site which have reached 25MVA.

It has already been shown in our earlier articles how the dam is built in the form of concrete blocks, 50ft wide and 130ft long, the interfaces between adjacent blocks being grouted. A system of cooling pipes carrying cold water is built in at 10ft intervals and the complete dam will contain over 600 miles of these pipes. After each layer of pipe follow five consecutive 2ft layers of concrete which are distributed by bulldozers and compacted by tractor-mounted vibrators. The dam is sealed to the rock by an injection apron for which a total of 30,000 borings were made.

Weather conditions limit site work to the summer season and only some maintenance work is possible in the winter. Nevertheless, 1,000,000 cubic yards of concrete were placed this year. A labour force of between 1500 and 2000 work an eleven-hour day shift and a ten-hour night shift with breaks totalling 1½ hours per shift. Although care is taken to reduce heavy manual labour to a minimum, weather conditions and the long hours render work very arduous, and special attention is therefore paid to housing and diet. The men are accommodated on site, as close as possible to their place of work, in three camps at Le Chargeur (900 beds), Blava (320 beds) and Prafleuri (350 beds). At Le Chargeur, a large prefabricated aluminium building of nine storeys, the "Ritz Hotel," houses 450 men and contains also a restaurant, cinema with 400 seats, welfare services and shops.

The scheme first produced power on March 7, 1958, and is expected to be completed in the summer of 1965 at a cost of about £140 per kilowatt. The accompanying illustration shows a photograph by Paris-Burgat of Lausanne.

* (1) "Some Recent Swiss Hydro-Electric Schemes," THE ENGINEER, April 9-26 and May 14-June 25, 1954. (2) Supplement to THE ENGINEER, June 19, 1959.

Second Reactor for Karlsruhe

A few days ago work began at the nuclear research station at Leopoldshafen near Karlsruhe, in connection with the erection of a second research reactor. The installation will comprise a Siemens "Argonaut" reactor, a gastight reactor building and an adjacent laboratory. The reactor has a continuous thermal rating of only 10W and is intended for research requiring only a very low reactor power ; in addition, it will be used for training and demonstration purposes. The core is a cylinder of annular cross section, containing aluminium-canned fuel elements and the graphite moderator. The core is immersed in water and is surrounded by a graphite reflector and a radiation shield built up from separate blocks of concrete. A large number of radiation channels and a mobile water tank are available for experiments. The water in the core is constantly circulated in a closed system and cooled by a second system which is also closed. This ensures that no water from the reactor can reach the general drainage system.

The reactor building will be a cylindrical welded steel shell, and the interior will be fully air-conditioned. The laboratory will be equipped for nuclear measurements and for chemical work. Main contractors for the whole installation is a group formed by the firms Siemens-Schuckertwerke A.G., Erlangen-Berlin ; Lurgi Gesellschaft für Chemotechnik m.b.H., Frankfurt/Main ; and Pintsch Bamag A.G., Butzbach/Hessen.

CONTINENTAL AFFAIRS *(Continued)*

260-ton articulated locomotive for Luleå-Narvik ore line

Heavy Locomotive for Ore Line

As a result of the decision to increase iron ore production in Lapland, the railway line from Luleå to Narvik is being reconstructed. The cost of the work is being kept comparatively low by rebuilding the track for a higher axle loading, thus avoiding the necessity for laying a second track or extending the passing loops.

The need to raise the railway's carrying capacity was first felt as early as fifty years ago, when by means of electrification the capacity was doubled. Since then, the weight of the trains on the busiest section of the line, between Kiruna and Narvik, has grown from 2000 tons in 1920 to 3200 tons in 1955. Present plans envisage the weight to be raised further to 4900 tons. Compared with an ordinary goods train of 600m to 650m length which may weigh about 900 tons, an ore train weighing 3200 tons is only 400m long, and thus represents a load concentration several times greater.

It is obvious that such trains require the use of especially heavy locomotives, and what is claimed to be the most powerful locomotive in the world, as far as tractive effort is concerned, was ordered by the Swedish State Railways in July, 1958, and has recently been delivered.

The locomotive is an articulated design consisting of three sections with axle arrangement 1D+D+D1. While earlier articulated locomotives consisted of two sections, each with three driven axles, the locomotive for the 3200-ton trains of 1955 was provided with four driven axles in each section, and all four sets were connected by coupling-rods, thus considerably increasing the adhesion. Now, a further step has been taken by adding a central unit, also with four coupled driving axles but without trailing axles, driving cabs, or pantographs.

Each of the end sections is 12,405mm long, and the length of the central portion is 9860mm ; including the intermediate couplings, the length over buffers amounts to 35,250mm. The total weight is 258 tons and the adhesion weight about 230 tons.

Each section is equipped with main circuit breaker, transformer and voltage regulating unit as well as two traction motors.

The six motors together develop 7500 h.p. Maximum tractive effort at 4500A per motor is 79·5 tons, and the maximum speed is 75 km.p.h. Continuous rating is 2440A per motor, corresponding to a speed of 57·8 km.p.h. Until a new kind of ore truck with stronger couplings, which is now being built, is put into service, these locomotives cannot be exploited to the full, the train weight remaining restricted to 3200 tons instead of the 4900 tons which they are capable of hauling.

Like almost all Swedish locomotives, the new design has been supplied by ASEA in co-operation with AB Svenska Järnvägsverkstäderna, AB Motala Verkstad, and Nydqvist & Holm AB.

Contact Resistance of Metal Sheet

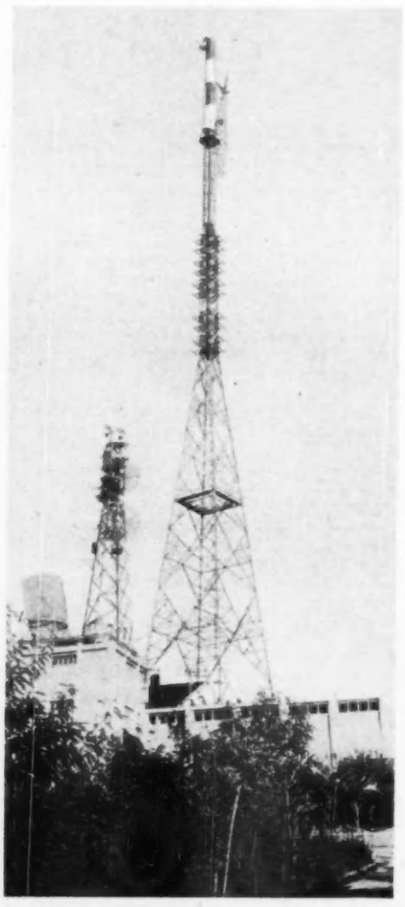
For the resistance welding of sheet material, in particular in the case of light alloys, the contact resistance between the two sheets is of great importance. Usually by means of pickling or wire-brushing this resistance is brought to its optimum value. In order to be able to judge whether that value has been reached, Siemens-Schuckertwerke A.G., Berlin-Erlangen, has produced an instrument which directly indicates the resistance in micro-ohms. In its design a basic difficulty has been circumvented, viz., the fact that the resistance to be measured and the resistance between the material and the electrodes are of the same order of magnitude.

As shown in the accompanying illustration, the instrument comprises a hydraulic press together with the electrical set. It is the function of the press to simulate the compressive action of the welding electrodes ; the pressure can be set at any value up to 5 tonnes. Two sheets or samples are inserted and a current of known value which can be set and measured by the electrical equipment is passed between them. The voltage drop across the contact area is taken off by two clips and measured on a millivoltmeter directly calibrated in the ranges 150, 500 and 5000 micro-ohms.

A small 5-tonne hydraulic press simulates the electrode pressure of the welding machine. The electrical equipment (left) permits direct measurement of contact resistance under a known current

Self-Supporting Plastic Cylinder for Television Aerial

For the transmission of the second Italian television programme, aerials for transmission in Channel IV are being erected at a number of places throughout the country. Our accompanying illustration shows the first of these nearing completion. The design has been developed by Siemens and Halske Aktiengesellschaft and incorporates a top section consisting of a self-supporting glass fibre-reinforced cylinder which supports the internally mounted aerial and at the same time protects it from the weather. No steel parts are present in the plastic tube, which is 22m long. The aerial is stated to have a gain of 50, with circular transmission. The station will be received in the Po delta, the Apennines, and the plain around the city of Trieste.



Television aerial at Monte Venda near Padua

THE AMERICAN SCENE

by Our American Editor

The General Electric Strike

THE American General Electric Company is one of the ten largest firms in the United States and operates 166 factories in twenty-nine States. The International Union of Electrical Workers represents 70,000 of the 110,000 organised G.E. workers. The union's five-year contract with G.E. expired on October 1. Last June it submitted demands for a new two-year contract including a 3½ per cent wage increase each year and continuation of a cost-of-living escalator clause. The company, which has always negotiated contracts on its own terms, rejected the demands on the ground that they would cost an "astronomic" 500,000,000 dollars. Instead, it offered a three-year contract including a raise of 3 per cent immediately and another one of 4 per cent on April 2, 1962, but eliminating the cost-of-living clause. Negotiations began early in September and soon were deadlocked. G.E. warned that its offer was final, that even if the workers struck they would get no additional benefits. It was management's take-it-or-leave-it attitude even more than its actual contract offer that alienated the union. At the end of September, the union took a strike vote. A majority of local branches voted to walk out. But the largest ones voted in favour of accepting the company's offer. The company maintained that the balloting showed a majority of workers to be against a strike. The union itself indicated it would be grateful for any concession that would enable it to avoid a strike. But the firm stuck to its terms, and the strike became effective on October 1.

The decision of the International Union of Electrical Workers to strike against the company precipitated a showdown test for a controversial new management philosophy of labour relations. The outcome of the battle was likely to affect the power balance between unions and companies in the American mass production industries even more fundamentally than did last year's 116-day steel strike. For the last twelve years General Electric has been using advertising techniques to convince its 240,000 employees that the company, not the union, is the best guardian of their welfare. As part of this effort General Electric moved into the driver's seat in collective bargaining, in contrast to the readiness of most other American industrial giants to content themselves with a defensive part in combating union demands. The firm's policy is to lay down a contract package and stick to it, with only minor modifications, even if it means taking a strike. A cornerstone of this technique is a warning to the workers that, if they do walk out, the company will not increase its offer, no matter how long the strike lasts. Organised labour viewed this policy, almost from the start, as a formula for union-busting, and the initial reaction of other big companies to the General Electric approach was almost as cold as that of labour. In the last few years, however, a substantial number of the early scoffers have become disciples of the G.E. gospel. In part, their conversion flowed from a sense that the era of good feeling in labour relations had cost management too many prerogatives without adequate compensation in the form of union co-operation to promote efficiency. An even more potent persuader was the firm's consistent success in negotiating contracts on its own terms while avoiding the paralysing strikes that repeatedly beset employers who bargained on more orthodox lines. Most leaders of the American Federation of Labour, and the Congress of Industrial Organisations made little secret of their fear that the "get tough" attitude in management would become a tidal wave if General Electric forced the strikers to return to work with no improvement in its original offer or if the union ranks crumbled under the force of back-to-work sentiment. The electrical union spent much of the last week of September demonstrating that it would welcome any excuse for delaying a walk-out. It let it be known that it was ready to declare a truce to permit the intervention of arbitrators, fact-finders or any other outside peacemakers. The company rejected all such proposals. It took the view that its contract proposal represented the maximum that it would give and that the injection of Federal or State influence would create "false hopes" on the part of its employees that delay would bring a fatter wage package or other concessions.

A letter circulated among the management personnel set forth the company's conviction that James B. Carey, the union's president, was leading his organisation toward "inevitable disaster" by promoting the walk-out. It noted that several of the union's biggest local branches had recorded their hostility to quitting work and that some of Mr. Carey's allies were less than enthusiastic about going along with his rejection of the G.E. offer. The company evidently counted on a rank-and-file revolt to end the strike. It used direct mail and newspaper advertisements to notify its workers that their jobs would be waiting for them at their regular wages and with all seniority and fringe benefits intact and that they had every legal right to cross the picket lines. This was the first time since World War II that such a large company had sought to operate in the face of a strike.

The strike was settled on October 22, on the original terms offered by the Company. The storms that, consequently, thrash about Mr. Carey have focussed fresh attention on the powers and problems of union leaders. In the classic bread-and-butter conception, the job security of any top unionist is built on his ability to keep bringing home a richer diet for his wards. General Electric has made this a much more vexing problem for Mr. Carey than it is for most union heads—not because it gives too little but because its way of giving makes it hard for the union to convince its dues-payers that they have the union to thank for the contract blessings they receive. For twelve years the company has been devoting time, ingenuity and money to persuading its workers that G.E. is so concerned with their welfare that it needs no prodding from the union to give them higher wages, liberalised pension and insurance benefits and improved job protection. It has discarded what it calls "auction-type bargaining" in favour of a new negotiating technique, under which it puts everything it considers right in its initial offer and sticks to it, with minor modifications, even if it means a strike. The union contends that the end purpose of the G.E. technique is to put it out of business by stripping it of any useful function and thus leave the company in untrammeled control of its employees. However, the union's success in whipping up any militant spirit of protest among its rank and file has been handicapped by the forcefully expressed belief of many members that the company's contract packages have been too attractive to justify a strike. This is the essential difference between the G.E. approach and that of other large corporations that have sought to copy its resolute posture in union negotiations. Most of the emulators forget that G.E. puts a tempting dish of economic benefits on the bargaining table and does not surround it with a long list of contract retrogressions calculated to give the union a fighting issue. This avoids the kind of united resistance steel workers displayed last year in striking for 116 days against their industry's demand for a free hand to change established work rules. In preparation for this year's contract showdown, Mr. Carey won convention approval for constitutional changes intended to give him greater authority to squelch dissident sentiment in the conduct of strikes. The union chief lost no time in letting the company know that he considered its "package" totally unacceptable. He added that he would oppose any offer made on a "take-it-or-leave-it" basis, no matter how juicy its contents. However, the taking of strike votes in the fifty-eight local branches failed to produce the show of near unanimity in support of a walk-out that officials of other unions count on as an automatic weapon in the arsenal they utilise against employers whenever a deadlock in negotiations develops.

The company, convinced that Mr. Carey was headed for disaster, rejected a series of frantic last-ditch efforts by the union chief to head off the walk-out he had initiated. The union's biggest local branch, representing 8700 workers at the company's home works in Schenectady, was late getting into the strike and early getting out. This defection brought an assertion by Mr. Carey that the local leader, Leo Jandreau, deserved a niche in infamy alongside such traitors as Benedict Arnold. Mr. Jandreau promptly retorted that Mr. Carey was captaining a suicide expedition that would be recorded in labour history as "Carey's Folly." The union, faced with compelling signs that its ranks would disintegrate if the walk-out dragged on, was resigned to accepting a settlement on the terms that were available to it before the strike. Mr. Carey's main interest had been to achieve peace with honour that would forestall a general collapse. What defeated him in his endeavour to break through the G.E. defences

THE AMERICAN SCENE *(Continued)*

was the unwillingness of his own union to give him wholehearted support, his own impetuosity in proceeding to strike under such circumstances and a divided manpower situation that would have enabled the company to keep the bulk of its people on the job even if the Carey union had remained solid.

Fewer than one-third of the 240,000 workers at General Electric belong to his organisation, and he received no practical support from those who belonged to other unions or were wholly unaffiliated. To all these handicaps was added a slack economic situation that made G.E. more grateful for a cut in its swollen inventories of unsold products than it was anxious about the fall-off in new manufacture. Mr. Carey's own future seems in little jeopardy. He was elected only in September to a new four-year term as president, and most of his high command can be expected to back his contention that the strike was an essential challenge to "industrial dictatorship." However, secession moves are certain to start in some disgruntled local branches. One such move already has begun in a 900-member unit at Burlington, Vermont. Under the A.F.L.–C.I.O. "no-raiding" pact, the dissidents cannot find a new home within the federation. But there is little doubt that they will be welcome in such exiled unions as the United Electrical Workers and the International Brotherhood of Teamsters.

Machine Tool Exposition and Production Engineering Show at Chicago

No. V (*Continued from page* 916, *November* 25)

The 1960 *Machine Tool Exposition and the Production Engineering Show were held, respectively, at the International Amphitheatre and the Navy Pier in Chicago from September* 6 *to* 16 *and were attended by over* 150,000 *visitors. Compared to the previous exhibitions held in* 1955, *there has been a major increase in the application of numerical control to both standard and special-purpose machine tools. This article reviews the more important advances in the design, construction and performance of the machinery shown and deals particularly with the present state of automatic machine tool control in the United States.*

Reliance Electric and Engineering Company

The Reliance Electric and Engineering Company, of Cleveland, Ohio, exhibited a two-axis, point-to-point programmed numerical control system applied to a special drilling machine (Fig. 36) with a six-face turret head made by the Lahr Machine and Tool Corporation, Toledo, Ohio. The machine comprises a 90in long fixed table over which is mounted a Brown and Sharpe Model B six-face turret drilling head which has 90in of programmed movement in the longitudinal axis and 20in of programmed movement in the transverse axis.

The numerical control positions the head (X-axis, left-right), and the saddle (Y-axis, in-out), selects the correct turret face and initiates the spindle down movement. A switch is built into the turret to control the turret rotation and return a signal when the correct face is locked in position. Limit switches and adjustable dogs on the spindle control the drill cycle operation and set the drill depth.

The head and saddle are driven by ¾ h.p., 1150 r.p.m., d.c. motors powered by reversing electronic drives. They are simultaneously driven to the programmed positions by the positioning motors under numerical control. The control equipment is designed so that the head and saddle always approach the final command positions from the same direction. Full-range zero-offset control is provided for both the head and saddle motions, allowing the zero datum lines to be set to any position desired.

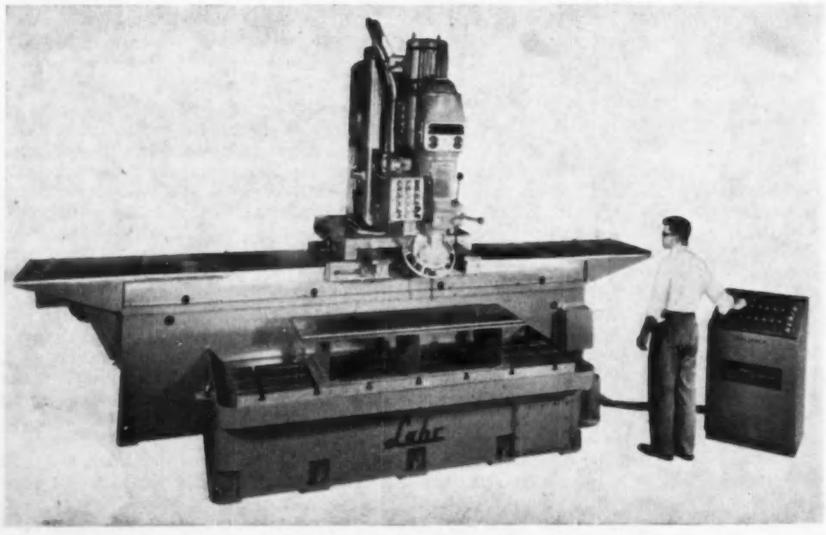


Fig. 36—Lahr six-face turret head drilling machine with "Reliance" numerical control system

Both programmed motions, head and saddle, can be programmed to 0·001in. In addition, each is programmable to either side of its datum zero line, if "plus-minus" programming is to be used.

The tape programming of the selection of one of the six turret faces is provided as an auxiliary function. In addition, there is an auxiliary coolant "on-off" function. A drill "yes-no" function is provided to allow the head and saddle to move to a programmed position, and not to drill a hole. This is used primarily to programme the spindle movement around obstructions without drilling unwanted holes.

Any one of four modes of operation may be selected by means of a selector switch: automatic, single cycle, dial, or manual. Operation in these modes is as follows: in fully automatic operation of the machine under control of the tape, the machine will go through its cycle until the end of the programme is reached. In single cycle, the machine operation is controlled by the tape, but under the close supervision of the operator, and would be used for a close check on operation using a newly-prepared tape. When the operator pushes the start button, the head and saddle move to their commanded positions and the correct turret face is rotated into position. The machine will stop when these commands are executed, and the operator may check the correctness of the set-up. When the operator again pushes the start button, the spindle comes down and drills the hole. During this operation new data is read from the tape for the following operation. The machine will again stop after the tool is withdrawn.

In the third mode, the machine is controlled by settings of the dial switches rather than by the tape. Finally, in the manual mode, complete operator control by jog push-buttons is provided and the numerical control is inoperative.

Moog Servocontrols

An interesting machine tool control system, which substitutes pneumatic-hydraulic control for electronic circuitry, was displayed by Moog Servocontrols, Incorporated, East Aurora, New York. The so-called "Hydra-Point" system represents a revolutionary approach to point-to-point positioning. Metal cutting instructions stored on punched tape are converted to highly accurate table positions by a simple hydraulic device which does not involve the use of electronics. The standard system includes a tape reader, a hydraulic power supply, a control console and table positioning actuators.

Each axis of the positioner employs a hydraulic positioning servo. This servo may be thought of as basically similar to the "tracer" servo shown in Fig. 37. In this arrangement, the machine

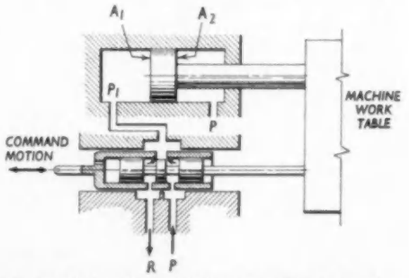


Fig. 37—Hydraulic worktable positioning servo system

work table is moved by a hydraulic actuator. The actuator operating pressure, P_1, is controlled by a three-way servo-valve. When the valve control port is opened to supply pressure, P, the piston will be driven outward. Conversely, when the control port is opened to return, the piston will be retracted by supply pressure acting on the area A_2. When the valve spool land is exactly centred on the port, pressure P_1 becomes equal to half the supply pressure P. Then the piston will come to rest since

piston area A_1 is equal to twice that of area A_2. Thus, with the valve spool connected to the work table, a "follow-up" servo is formed such that if the valve porting sleeve is moved, the table will exactly follow it.

If a means were provided whereby the valve control port could be selectively moved to a number of discrete positions, it could form the basis for a numerical positioning system, as shown in Fig. 38. By means of a multi-position

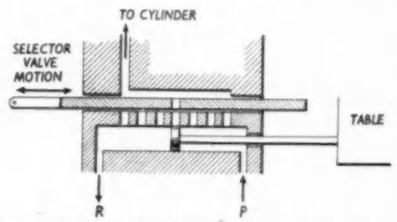


Fig. 38—Numerical positioning system using a multi-position selector valve

selector valve, the valve control port is effectively moved to any one of a number of identical ports in the valve body. This arrangement will function to feed hydraulic oil to the cylinder so that the table will move to the position where the valve spool land is centred on the particular port connected to the cylinder by the selector valve.

The absolute positioning accuracy of this servo is determined by the accuracy of location of the selectable valve port holes, which effectively serve as fixed gauge points. These holes can be practically located within 0·0001in. Furthermore, by closely controlling the port hole size so that the diameter of any hole very nearly matches the valve land width, the valve can be

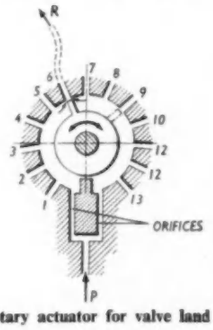


Fig. 39—Rotary actuator for valve land control

made to control cylinder pressure over its full range for extremely small motions. Thus, whenever any given port hole is selected, the servo will always repeat that position of the table within a few ten thousandths of an inch, even under maximum work table friction loads.

The mechanism described embodies the basic principle of the Moog numerical positioner. However, in order to make a practical positioner, it is necessary to provide for the selection of any dimension in 0·001in increments without the use of an unreasonable number of gauge point holes. Also, a simple selector valve must be provided which can be simply operated from punched tape. The first requirement is met by using gauge point holes located every 0·100in and interpolating them by means of a helical valve land. The valve land will, therefore, act as a single turn micrometer screw. Each of 100 incremental angular positions of the valve advances the effective gauging point by 0·001in.

The rotation of the valve land is accomplished by a vane-type rotary actuator which is shown in simplified form in Fig. 39. The angular position of the vane is controlled in a manner basically similar to the technique used in selecting the axial gauge point holes. A multi-position selector valve is used to connect any of one hundred holes located in the rotary actuator face plate to return pressure. As the cavities on both sides of the rotary vane are supplied with pressure oil through pressure dropping orifices, the vane will move until it has become centred over the selected hole.

Both the linear and rotary selector valves are formed by stacks of two-position, multi-port, sliding plate elements. The number of plate elements used in each case depends upon the number of discrete combinations required. For a 10in stroke actuator both selector valves must provide at least 100 combinations and accordingly eight plate elements are used in each valve. The linear selector valve must be capable of establishing a gauge point corresponding to the inches and tenths of the desired position. Similarly, the rotary actuator must assume an angular position corresponding to the hundredths and thousandths of the desired position. The position of each plate corresponds to the presence or absence of a hole in the punched tape as determined by a pneumatic block tape reader. Position information is stored in binary coded decimal form on 1in wide eight-channel punched tape. The combination of all the previously described elements to form the complete positioning system is shown in simplified form in Fig. 40.

Fully automatic machine positioning is accomplished in the following sequence. Pushing the "Cycle Start" button on the control console causes a motor-driven Geneva mechanism to bring the first block of punched tape into position in the tape reader. A sequence cam then applies air pressure to position the selector valves in accordance with the tape punching. When the valves have been positioned, hydraulic pressure is applied to drive the table actuators to the required positions. When table motion stops, hydraulic pressure is removed from the table actuators and air pressure is applied to the table clamps. This air pressure also closes an electrical contactor to initiate tool feed. Pneumatically operated switches are activated from the tape reader to control the tool, coolant and feed selection system.

Semi-automatic and manual modes of operation may also be selected by a switch on the control panel. The semi-automatic mode is intended for use during tool set-up and provides for manual initiation of machine operation. In the manual mode operation, no tape is used in the reader. Instead, table position may be set by the operator by means of dials on the control console. Tool selection and feed then revert to the machine control panel.

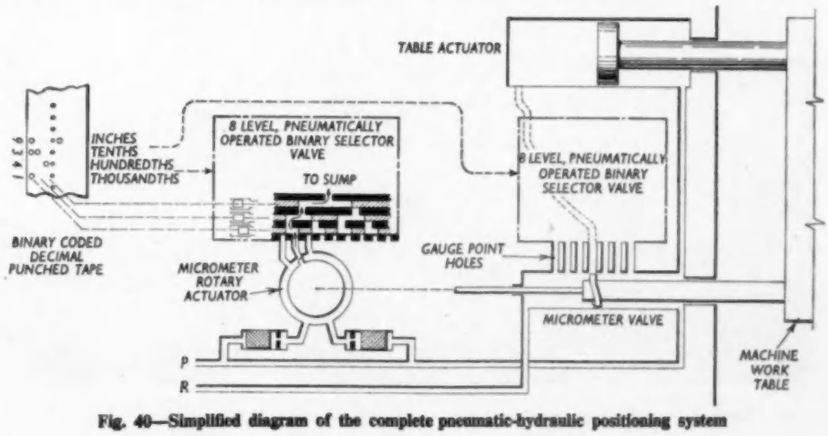
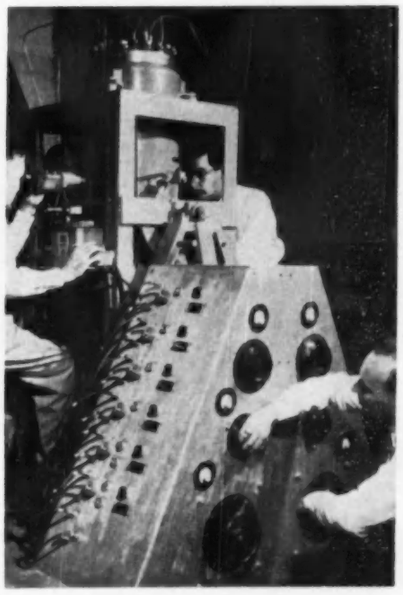


Fig. 40—Simplified diagram of the complete pneumatic-hydraulic positioning system

Gallium Phosphide Single Crystals

Engineers at the Bell Telephone Laboratories are at present developing methods of growing single crystals of a transparent semiconductor, gallium phosphide, and studying its properties. These studies will help in the basic understanding of high energy gap semiconductors.

Gallium phosphide belongs to the family of semiconductors referred to as "III-V compounds," which are composed of elements taken from each of the III and V groups of the periodic table. Knowledge gained in studying it should be applicable to other members ofthis group, some of which are already known to exhibit interesting properties. These include gallium arsenide and indium antimonide, which have shown promise in devices such as point contact and Esaki diodes.



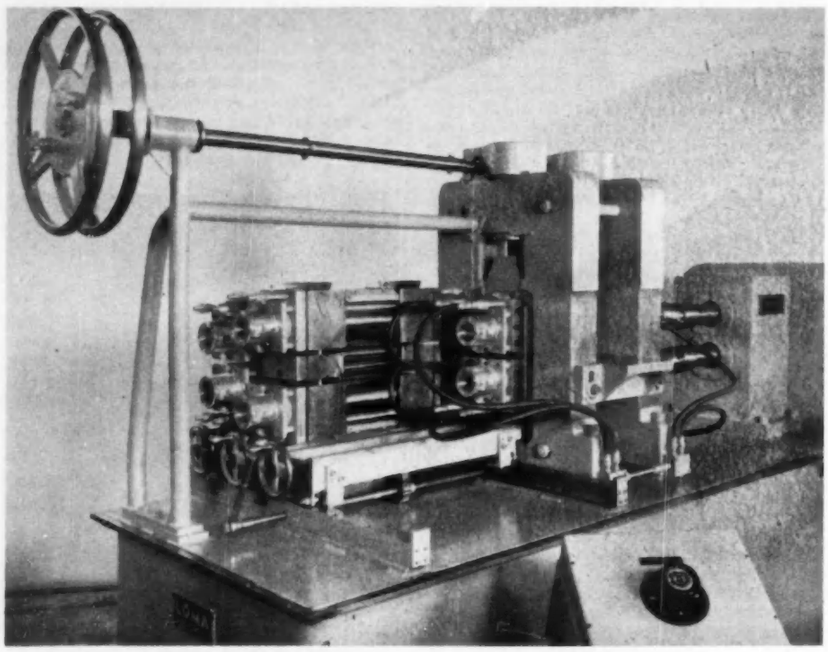
Production of gallium phosphide ingot

Although the semi-conducting properties of gallium phosphide were first reported in 1954 by G. G. Folberth and F. Oswald in Germany, pure samples have been very difficult to prepare. One of the main problems is that it decomposes at temperatures near its melting point unless it is held under high pressures of gaseous phosphorus. The work at Bell has been aimed at producing single crystals of gallium phosphide by the floating zone melting technique, and special equipment had to be built to withstand the high pressure phosphorous atmosphere. In the experimental equipment, an ingot of gallium phosphide is enclosed in a sealed quartz tube which is encased within a steel pressure chamber equipped with viewing ports. At the temperatures and pressures involved (1450 deg. to 1500 deg. Cent. and 10 to 50 atmospheres), the walls of the quartz tube fog over, making observation of the molten zone difficult. This can be overcome to a large extent by heating the walls of the apparatus to above 950 deg. Cent. Single crystals about $\frac{3}{4}$in long by $\frac{1}{4}$in square have been obtained by Frosch and Gershenzon, and small single crystals have also been grown by vapour reaction methods by Gershenzon and Mikulyak. Their method involves a reaction of gallium suboxide (Ga_2O) and phosphorus in the vapour phase. These crystals show a whisker form or habit, and they are usually *n*-type semiconductors, although they can be doped *p*-type.

Diffused and alloyed diodes have been produced by Gershenzon and Mikulyak. Sample diodes have shown breakdown voltages as high as 35V, and rectification ratios up to 3×10^6. They perform well up to 500 deg. Cent. The diodes exhibit two interesting anomalies; they have an almost intrinsic layer which gives rise to a current-limiting series resistance, and they possess recombination-generation centres within

THE AMERICAN SCENE *(Continued)*

the junction transition region. These produce variations in the forward and reverse current characteristics and time lags in the establishment of steady state conditions.



Combination rolling mill for processing of plutonium at the Argonne National Laboratory

Plutonium Rolling Mill Installation

A heavy-duty, high-precision two-high/four-high combination rolling mill was recently installed at the new Fuels Technology Centre of the Argonne National Laboratory at Argonne, Illinois. The outstanding feature of the new machine is its complete enclosure in a controlled atmosphere glovebox to allow the processing of alpha-active, pyrophoric materials, such as plutonium. To facilitate remote control operation within the glovebox enclosure, the mill is equipped with a mechanised roll changing device comprising a roll storage car, three slideways to carry three roll assemblies, quick-disconnect screwdowns and universal spindle supports. As shown in the accompanying illustration, the entire roll assemblies are readily moved into or out of the mill by turning a hand-wheel and are cross-transferred by moving the car along the face of the mill. Thus, complete roll changes can be performed in a few minutes without undue effort.

The new rolling mill was designed and built by the Loma Machine Manufacturing Company, of New York. The machine may be operated in either a 6in by 8in two-high set-up or a 1½in and 6in by 8in four-high set-up. The two-high arrangement is used for either hot or cold breakdown rolling of plate and sheet, and grooved rolls are also available to process rounds from 1in to ¼in diameter. In the four-high set-up strip is cold finish rolled to gauges as thin as 0·002in.

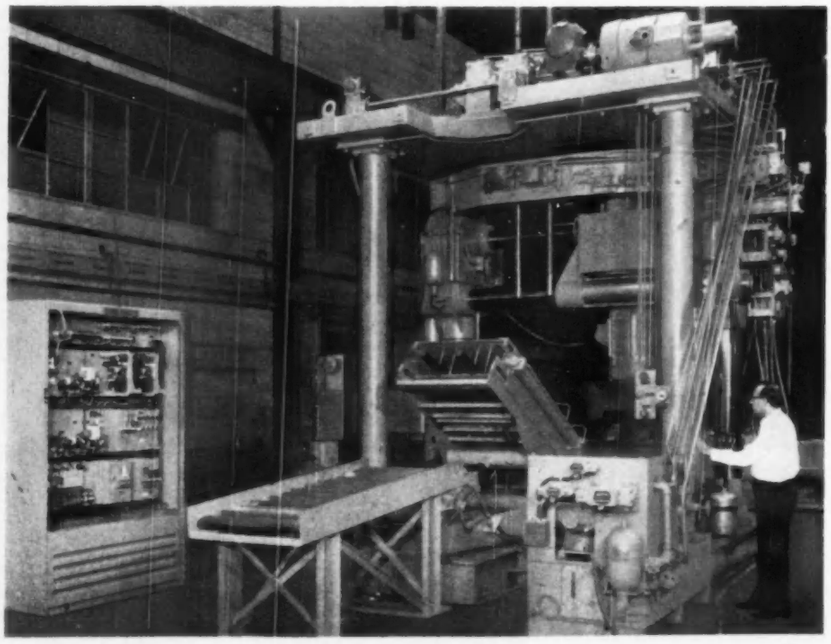
Continuous Casting Plant for Australia

A fully continuous casting machine was recently supplied to the Port Kembla Works of the Electrolytic Refining and Smelting Company of Australia by the Loma Machine Manufacturing Company of New York. The equipment is particularly versatile so as to cope with a wide production programme ranging from phosphor de-oxidised to oxygen-free copper and including round piercing and extrusion billets, square wire bars and rectangular slabs. The production capacity of the machine ranges from 3 tons per hour for double-strand casting of 3in diameter billets to 10 tons per hour for single-strand casting of 5½in by 33in slabs.

The continuous casting machine is fed with liquid metal from a drum-type induction melting furnace followed by a drum-type induction holding furnace. The molten copper then flows through a special refractory-lined enclosed distributor equipped with down spouts extending into the moulds. The rate of flow of the metal through the down spouts extending below the metal surface is controlled by needle valves. This " underpouring " method assures a smooth, splash-free entry of clean metal into the mould cavity, thus eliminating internal porosity and inclusions in the cast material. The billet, bar and slab moulds are of graphite-lined copper construction and are mounted at the top of the casting machine. The mould water jackets employ a special internal baffle design which greatly enhances their heat removal capacity. The cooling water initially flows through the mould jackets and then emerges from an adjustable slot at the mould bottom to impinge on the solidified metal surface in direct spray form. The spray water is collected in a water box mounted below the moulds and is recirculated. To prevent sticking of the copper to the mould, the entire mould assembly is oscillated by a reciprocating gear. The vertical stroke is adjustable up to ¼in, and the rate of vibration can be adjusted up to several hundred cycles per minute by means of a variable speed drive.

The solidified metal strands are continuously withdrawn from the moulds by a double set of 10in diameter pinch rolls made of stainless steel. Immediately below the withdrawing rolls and mounted on a travelling carriage is the flying circular cut-off saw, designed to cut lengths from 30in to 72in. The vertical travel of the saw is along two of the four main columns of the machine, while its horizontal travel is along two horizontal columns on which the travelling carriage is guided. During cut-off, the descending castings are engaged by hydraulically operated clamps situated close to the sawblade. The saw employs a 38in diameter high speed steel segmental blade driven by a 50 h.p. motor at 1200ft per minute. The entire cycle of clamping carriage, descent, saw advance, saw return and carriage return is performed automatically.

The cut billets or slabs are received in the discharge basket which is tilted automatically by a pneumatic cylinder through 90 deg. Once the basket reaches its horizontal position, the castings are ejected on to a roller conveyor by air cylinder action. The casting machine can also be employed on a semi-continuous basis, allowing the production of " logs " up to 20ft lengths and up to 5000 lb weight. For this purpose clearance has been provided in the machine base and a special pit will be included in the foundation, allowing the logs to be removed from the machine on a slant by means of overhead crane facilities.



Loma continuous casting machine for the production of copper billets, wire bars and slabs

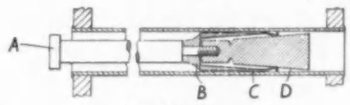
BRITISH PATENT SPECIFICATIONS

The dates printed are those of application and publication on completion. Copies of specifications may be obtained at the Patent Office Sales Branch, Southampton Buildings, Chancery Lane, W.C.2, 3s. 6d. each

TUBES

852,216. June 10, 1958.—TUBE PLUGGING DEVICE, Esso Research and Engineering Company Elizabeth, New Jersey, United States of America.

This invention relates to a plugging device particularly for plugging leaking tubes of heat exchangers, boilers and the like. The device includes a rod or a cable *A* having a threaded stud at one end, and a collar *B* having a tapered surface is slidably mounted on the stud. A sleeve *C* is set between the collar and a plug member *D*. One end of this plug *D* has a smaller cylindrical portion threaded on the stud. The other and larger end of the plug member has a tapered surface and is separated from the



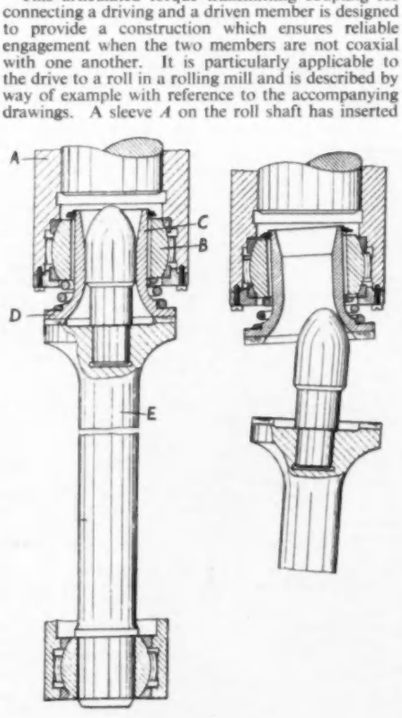
No. 852,216

small cylindrical section by a groove providing a weakened section. The sleeve has spring clips formed at one end which compress to fit the tube when the rod is moved inwards. The sleeve is pushed right through the tube and then pulled back allowing the spring clips to expand and engage the far, inaccessible, end of a leaky tube. The plug member wedges the sleeve against the inside wall of the tube when the rod is further withdrawn. The pull on the rod is increased until the plug breaks at the weakened section leaving the tapered plug tightly wedged in the sleeve. The rod and collar are removed for re-use.—*October* 26, 1960.

COUPLINGS

854,245. August 23, 1957.—ARTICULATED TORQUE TRANSMITTING COUPLINGS, Moeller und Neumann G.m.b.H., St. Ingbert, Saargebiet, Germany.

This articulated torque transmitting coupling for connecting a driving and a driven member is designed to provide a construction which ensures reliable engagement when the two members are not coaxial with one another. It is particularly applicable to the drive to a roll in a rolling mill and is described by way of example with reference to the accompanying drawings. A sleeve *A* on the roll shaft has inserted



No. 854,245

spherical internal teeth meshing with an articulation member *B*. This articulation member has in its bore internal teeth engaging with teeth on the periphery of a sliding sleeve *C*. This sliding sleeve has at its upper end a retaining ring and a flange *D* on its other end has coupling teeth on its end face. The sliding sleeve has a bore bell-mouthed towards the flange. A pre-compressed spring is arranged between the flange of the sliding sleeve and the articulation member *B*. A spindle *E* which establishes the driving connection has on the end facing the roll stand a flange which is provided with coupling teeth to engage the teeth of the flange *D*. The drive spindle has a spigot which fits into the bore of the sliding sleeve and this spigot serves as a feeler member for the automatic centring of the parts to be coupled. The other end of the drive spindle is connected to the drive in a conventional way. When a new roll is being inserted the spigot first enters the bell-mouthed bore of the sliding sleeve and then automatically centres the spindle in the sliding sleeve by its cylindrical portion entering into the cylindrical bore of the sleeve. If the distance between centres of two rolls is different from that of the corresponding pinions, the articulation member *B* automatically adjusts itself to the position of the spindle. The roll with its associated parts is then advanced towards the drive spindle until it has reached its final position. In most cases the clutch teeth of the sleeve and those of the drive spindle flange will not enter into engagement but abut against each other. The spring is then compressed by an amount corresponding to the height of the teeth so that the sliding sleeve will be moved towards the roll by a corresponding amount. If the spindle is then turned the spring expands and the teeth engage automatically to couple the drive.—*November* 16, 1960.

METALLURGY

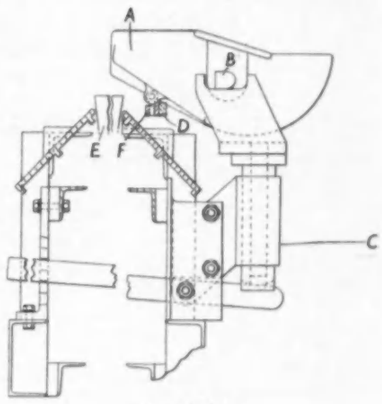
854,461. April 4, 1957.—REDUCTION OF NICKEL OXIDE, Mond Nickel Company, Ltd., Thames House, Millbank, London, S.W.1. (*Inventors: DeWitt Henry West, Stanley Charles Townshend and Alexander Bowen Simpson.*)

One way of reducing nickel oxide to metallic nickel is to heat the oxide in the presence of a reducing gas, for example hydrogen or water gas, in a rotary kiln or other container in which the particles of oxide and metal are in motion. Such reduction may be effected as a preliminary step to the production of nickel carbonyl from the reduced nickel. For this purpose the reduced nickel is required as a fine powder, and this is produced if the material fed to the kiln is finely ground sintered nickel oxide obtained by roasting nickel matte, and if the container is externally heated, e.g. by gas burning. Rotary kilns are commonly lined by steel or cast iron, and it is found that when such a kiln is used the metal powder produced in the kiln sticks to the wall. According to this invention the inner surface of a kiln that is in contact with the metal particles is constituted by a metallic material that forms a completely continuous oxide film which is not reduced at the operating temperature. It is found that sticking of the reduced metal powder is substantially eliminated by this simple method. It has been found that sticking is eliminated if the surfaces of the kiln or other walls are of aluminium, chromium, manganese or titanium, or material consisting predominantly of one or more of these metals. Aluminium or a material composed largely of aluminium is preferred. —*November* 16, 1960.

CASTING MACHINES

853,740. August 18, 1959.—INGOT CASTING MACHINES, T. Masters and Sons (Park Foundry) Company, Ltd., Park Foundry, Glover Street, West Bromwich. (*Inventor: George Masters.*)

According to the invention, the pouring box of a continuous casting machine is mounted so that the spout moves over a circular path in a vertical plane parallel to the direction of travel of the moulds to effect the pouring operation at intervals synchronising with the mould movement. The pouring box may be mounted to pivot about a horizontal axis and about a vertical axis, and a rod mounted on an eccentric pin at one end and on a slide at the other end is connected intermediate its ends to the pouring box to transfer said circular movement to the spout of the pouring box. The pouring box *A* can be tipped on the trunnion *B* about a horizontal axis and swivelled about a vertical axis on a spindle mounting *C*. A bar *D* is connected to an eccentric pin or crank arm driven from the main shaft of the machine. As each mould *E* on a conveyor chain passes the pouring box the bar is oscillated and the lug *F* moved in a circle in a vertical plane so that the pouring spout of the box follows a circle of movement equal to the pitch of the moulding boxes. The spout, whilst pouring, travels longitudinally with the mould being filled and is tipped to pour the metal into the mould. Whilst being raised at the end of



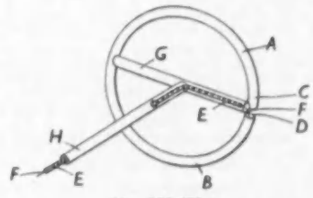
No. 853,740

this movement the spout returns to a position opposite the centre of the next succeeding moulding box to commence the pouring operation. The box receives metal from the furnace which is tapped to deliver at a predetermined rate. The bracket supporting the trunnions of the pouring box is adjustable in height to control the quantity of metal delivered on each tipping operation.—*November* 9, 1960.

TELECOMMUNICATIONS

853,472. April 7, 1956.—AERIALS, Electric and Musical Industries, Ltd., Blyth Road, Hayes, Middlesex. (*Inventor: Frederick John Henry Charman.*)

The object of the present invention is to provide an improved dipole aerial which affords a polar diagram similar to that of a pair of straight dipoles arranged side-by-side and parallel-fed, but in which the aerial is more compact compared with such an arrangement of dipoles. The aerial comprises a pair of limbs *A* and *B* as illustrated, each limb being approximately equal to half the operating wavelength of the aerial. The limbs are arcuate in shape and preferably semi-circular, as shown. Their ends are directly joined together at two of their adjacent ends, whilst the



No. 853,472

other ends indicated at *C* and *D* are spaced apart. These ends are connected to a suitable feeder which, in the example shown, comprises a concentric cable, the outer conductor *E* of which is connected to the end *C*, whilst the inner conductor *F* is connected to the end *D*. Diametrically arranged between the limbs is a cross-bar *G* which may be made of conducting material and connected between the joined ends of the limbs and one of the spaced ends *C* and *D*. In the example shown, the cross-bar is connected to the end *C* and in this case the outer conductor *E* of the cable can be joined to or mounted inside the cross-bar. The cross-bar may be arranged to be connected to an aerial support *H* which is connected to the centre of the cross-bar, the support being preferably tubular so that the cable can be passed through the support as shown in the drawing. If desired a reflector or reflectors and director or directors can be employed in conjunction with the aerial shown, or directivity may be improved by increasing the number of loops in the radiator plane. Arrangements of these kinds are illustrated in the specification.—*November* 9, 1960.

Forthcoming Engagements

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of their insertion, the necessary information should reach this office not later than a fortnight before the meeting. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS

To-day, Dec. 2.—LIVERPOOL AND DISTRICT BRANCH : Industrial Development Centre, M.A.N.W.E.B., Paradise Street, Liverpool, 1, "An Approach to the Use of Electrical Units," D. Chalmers, 7.30 p.m. ★ STOKE AND CREWE BRANCH : Royal Hotel, Crewe, "Variable Speed A.C. Motors," J. C. H. Bone, 7.30 p.m.

Mon., Dec. 5.—BOLTON BRANCH : Railway Hotel, Trinity Street, Bolton, "Railway Electrification," 7.45 p.m. ★ ESSEX BRANCH : Angel Hotel, Ilford Broadway, Essex, "Disregard of the I.E.E. Regulations," E. J. Sutton, 8.15 p.m. ★ LEEDS BRANCH : Great Northern Hotel, Leeds, "Lamps and Lighting," K. Haylor, 7.30 p.m. ★ SHEFFIELD BRANCH : Royal Victoria Hotel, Sheffield, "Application of Electrical Control : Oil and Gas Burners," D. Stretton-Smith, 7.30 p.m.

Tues., Dec. 6.—LEICESTER BRANCH : Westcotes Constitutional Club, Wilberforce Road, Leicester, Films, 7.30 p.m. ★ WEST LONDON BRANCH : Windsor Castle Hotel, 134, King Street, Hammersmith, London, W.6, "Railway Signalling," G. R. Kent, 7.45 p.m. ★ READING AND DISTRICTS BRANCH : "Marquis of Lorne," Friar Street, Reading, "Fire Protection," 7.30 p.m.

Wed., Dec. 7.—HALIFAX BRANCH : Crown Hotel, Horton Street, Halifax, "Design of Fittings," K. F. Haylor, 7.45 p.m. ★ NORTH LONDON BRANCH : Wood Green Civic Centre, Town Hall, Wood Green, N.22, "Control Systems on London Transport Signalling," G. R. Kent, 8 p.m. ★ SOUTH EAST LONDON BRANCH : Eltham Green School, Queenscroft Road, Eltham, S.E.9 "Coal Mines and Electricity," P. W. Wyke, 7.45 p.m. ★ PRESTON BRANCH : R.A.F.A. Club, East View, Preston, "Ernie," C. Ashworth, 7.30 p.m.

Thurs., Dec. 8.—BRADFORD AND DISTRICT BRANCH : Midland, Hotel, Bradford, "Miniature Circuit Breakers," S. W. Hornsey 7.30 p.m. ★ GLASGOW BRANCH : 29, St. Vincent Place, Glasgow, "Industrial Lighting," J. C. Holmes, 7.30 p.m. ★ SOUTH WEST LONDON BRANCH : Prince of Wales Hotel, London, S.W.19, "Electric Floor Warming," J. Cook, and "Instrument Transformers," R. Halloway, 8.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS

To-day, Dec. 2.—COMPUTER GROUP : London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C.1, "Progress in Microminiature Circuit Techniques for Digital Computers," D. Roberts, D. S. Campbell, and P. M. Thompson, 6.30 p.m. ★ SOUTH MIDLANDS SECTION : North Gloucestershire Technical College, Cheltenham, "The Place of the Electric Rocket in Space Propulsion," W. A. S. Murray, 7 p.m.

Wed., Dec. 7.—RADAR GROUP : London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street London, W.C.1, "Flight Evaluation of Airborne Electronic Equipment," H. G. Hinckley, 6.30 p.m. ★ NORTH-EASTERN SECTION : Institution of Mining and Mechanical Engineers, Neville Hall, Westgate Road, Newcastle upon Tyne, "Human Engineering," S. C. Ramsay, 6 p.m.

BRITISH INTERPLANETARY SOCIETY

Sat., Dec. 3.—Tudor Room, Caxton Hall, London, S.W.1, "The History and Future of Telescopes for Astronomical Observations," H. C. King, 6 p.m.

BRITISH PLASTICS FEDERATION

To-day, Dec. 2.—REINFORCED PLASTICS GROUP : Cafe Royal, London, Second International Reinforced Plastics Conference, 9.15 a.m.

COMBUSTION ENGINEERING ASSOCIATION

Tues., Dec. 6.—NORTHERN REGION : Griffin Hotel, Leeds. Discussion on "Coal Price Structure," 2.30 p.m.

ILLUMINATING ENGINEERING SOCIETY

Mon., Dec. 5.—LEEDS CENTRE : British Lighting Council, 24, Aire Street, Leeds, 1, "Interesting Lighting Installations," 6.15 p.m. ★ NEWCASTLE UPON TYNE CENTRE : County Hotel, Newcastle upon Tyne, "Looking at Lighting," A. Wilcock, 6.30 p.m.

Wed., Dec. 7.—EDINBURGH CENTRE : Y.M.C.A. Social Room, 14, South St. Andrew Street, Edinburgh, "The Lighting of Outdoor Industrial Plant," J. G. Holmes, 6.15 p.m. ★ SWANSEA GROUP : Demonstration Theatre, South Wales Electricity Board, The Kingsway, Swansea, "Lighting and Industry in the Soviet Union," E. H. Norgrove, 6 p.m.

Thurs., Dec. 8.—GLASGOW CENTRE : British Lighting Council, 29, St. Vincent Place, Glasgow, C.1, "The Lighting of Outdoor Industrial Plant," J. G. Holmes, 6.30 p.m. ★ MANCHESTER CENTRE : Demonstration Theatre, North Western Electricity Board, Town Hall Extension, Manchester, 2, "Ship Lighting," J. T. Grundy and C. H. Vaughan, 6 p.m.

INSTITUTE OF BRITISH FOUNDRYMEN

Thurs., Dec. 8.—BEDS AND HERTS. SECTION : Town Hall, Luton, "Aluminium Castings," J. Vickers, 7.30 p.m.

INSTITUTE OF MARINE ENGINEERS

Mon., Dec. 5.—STUDENT LECTURE : Memorial Building, 76, Mark Lane London, E.C.3, "Marine Steam Boilers," A. P. Monk, 6.30 p.m.

Tues., Dec. 6.—NORTH MIDLANDS SECTION : Yorkshire Imperial Metals, Ltd., Leeds, "Some Aspects of the Use and Fabrication of Non-Ferrous Tubes for Marine Pipelines," 7.15 p.m.

Wed., Dec. 7.—SCOTTISH SECTION : Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, Glasgow, C.2, "Recent Developments in the Welding of Pressure Vessels," H. Harris, 7.30 p.m.

Thurs., Dec. 8.—NORTH EAST COAST SECTION : Stephenson Building, King's College, Claremont Road, Newcastle upon Tyne, 2, "Ship Steering Gears," W. Spencer Paulin, 6.15 p.m. ★ DEVON AND CORNWALL SECTION : Demonstration Theatre, S.W. Gas Board, Radiant House, Derry's Cross, Plymouth, "Human Problems in Marine Engineering," C. C. Pounder, 7.30 p.m. ★ MERSEYSIDE AND NORTH WESTERN SECTION : Central Libraries, William Brown Street, Liverpool, "The Docks and Sea Channels of the Port of Liverpool," R. H. Stevenson, 7.30 p.m. ★ KINGSTON UPON HULL AND HUMBER AREA SECTION : Royal Station Hotel, Kingston upon Hull, "Some Observations on Ship Vibration," W. McClimont and P. W. Ayling, 7.30 p.m.

INSTITUTE OF METALS

Tues., Dec. 6.—SOUTH WALES LOCAL SECTION : Metallurgy Dept., University College, Singleton Park, Swansea, "'Valence' in Metals and Alloys," G. V. Raynor, 6.30 p.m.

Wed., Dec. 7.—MANCHESTER METALLURGICAL SOCIETY : Manchester Literary and Philosophical Society, George Street, Manchester, "The Relationship between Physical Test Results and Engineering Performance," J. H. Lambie, 6.30 p.m.

Thurs., Dec. 8.—BIRMINGHAM LOCAL SECTION : College of Technology, Gosta Green, Birmingham, "Beryllium," J. Williams, 6.30 p.m. ★ SHEFFIELD LOCAL SECTION : Applied Science Building, The University, St. George's Square, Sheffield, "Dislocations in Metals," P. B. Hirsch, 7.30 p.m. ★ EAST MIDLANDS METALLURGICAL SOCIETY : Faculty of Applied Science, Clifton Boulevard, The University, Nottingham, "The Fabrication of Steam Generating Equipment for Nuclear Power Stations," A. F. Gifford, 7.30 p.m. ★ SOUTHAMPTON METALLURGICAL SOCIETY : The University, Southampton, "Semi-Conductor Materials," J. G. Wilkes, 7.15 p.m.

INSTITUTE OF PETROLEUM

Wed., Dec. 7.—61, New Cavendish Street, London, W.1, "The Changing Energy Pattern in Europe and its Possible Effect on Product-Mix," M. E. Hubbard, 5.30 p.m.

INSTITUTE OF ROAD TRANSPORT ENGINEERS

Mon., Dec. 5.—MANCHESTER AND DISTRICT CENTRE : Fairbairn Room, Engineers' Club, Albert Square, Manchester, "The Future of Road Transport," A. Enticknap, 7.30 p.m.

Tues., Dec. 6.—EASTERN CENTRE : Davey, Paxman and Co., Ltd., Colchester, "Modern Vehicles for the Motorway," A. H. Carter, 7.30 p.m. ★ SOUTH WESTERN GROUP : Exeter Fire Brigade, Exeter, Technical Films, 7.30 p.m. ★ MIDLANDS CENTRE : Birmingham Exchange and Engineering Centre, Stehpenson Place, Birmingham, "The Future of Road Transport," A. Enticknap, 7.30 p.m.

Wed., Dec. 7.—EAST MIDLANDS CENTRE : Mechanics' Institute Nottingham, "Oil Additives," E. P. Wright, 7.30 p.m.

INSTITUTE OF WELDING

Wed., Dec. 7.—54, Princes Gate, Exhibition Road, London, S.W.7, First Annual Conference on "Welding Standardisation." 9 a.m.

INSTITUTION OF CHEMICAL ENGINEERS

Tues., Dec. 6.—LONDON BRANCH : Geological Society, Burlington House, London, W.1, "Study on Electro-Precipitator Performance in Relation to Particle Size Distribution, Level of Collection Efficiency, and Power Input," D. O. Heinrich, 5.30 p.m.

Wed., Dec. 7.—MIDLANDS BRANCH : Midland Hotel, Birmingham, "Noise Problems in a Large Refinery," M. B. Shirley, 6.30 p.m.

INSTITUTION OF CIVIL ENGINEERS

Tues., Dec. 6.—Great George Street, Westminster, London, S.W.1, "A Unit Hydrograph Study with Special Reference to British Catchments," J. E. Nash, 5.30 p.m.

Thurs., Dec. 8.—TRAFFIC ENGINEERING STUDY GROUP : Great George Street, Westminster, London, S.W.1, Informal Discussion on "Parking Control," introduced by J. T. Duff, 5.30 p.m.

INSTITUTION OF ELECTRICAL ENGINEERS

To-day, Dec. 2.—MEDICAL ELECTRONICS DISCUSSION GROUP : Savoy Place, London, W.C.2, Discussion on "Telemetering Biological Data," opened by G. H. Byford and K. G. Williams, 6 p.m.

Mon., Dec. 5.—INFORMAL MEETING : Savoy Place, London, W.C.2, Discussion on "National Proving of Domestic Electrical Equipment,' opened by C. A. Zwoigbergk, 5.30 p.m. ★ MERSEY AND NORTH WALES CENTRE : Royal Institution, Colquitt Street, Liverpool, "The Determination of the Electrical Characteristics of an Arc Furnace," J. Ravenscroft, 6.30 p.m. ★ NORTH-EASTERN MEASUREMENT AND ELECTRONICS GROUP : Rutherford College of Technology, Northumberland Road, Newcastle upon Tyne, "Radar Observations of Birds and 'Angels,'" E. Eastwood, 6.15 p.m. ★ SOUTH MIDLAND CENTRE : College of Technology, Birmingham, Combined Meeting with the Electronics and Measurement and the Supply and Utilisation Groups and the Birmingham Centre of the J.P.O.E.E., "Radiocommunication in the Power Industry," E. H. Cox and R. E. Martin, 6.30 p.m. ★ SOUTH MIDLAND CENTRE : Winter Gardens, Great Malvern, "Parametric Amplifiers," R. V. R. Carter and I. A. Bagnall, 7.30 p.m. ★ MAIDSTONE BRANCH : Technical College, Maidstone, "Uses and Manufacture of N.I.C.C. Cable," L. E. D. Redman, 7 p.m.

Tues., Dec. 6.—MEASUREMENT AND CONTROL SECTION : Savoy Place, London, W.C.2, "A Universal Non-Linear Filter, Predicter and Simulator, which Optimises Itself by a Learning Process," D. Gabor, W. P. L. Wilby and R. Woodcock, 5.30 p.m. ★ EAST ANGLIAN SUB-CENTRE : Stuart Hall, Norwich, "Engineering Aspects of Commercial Television Programme Presentation," T. C. Macnamara, 7.30 p.m. ★ NORTH MIDLAND CENTRE : Institute of Technology, Bradford, "Thermistors—Their Theory, Manufacture and Application," R. W. A. Scarr and R. A. Setterington, 6.30 p.m. ★ NORTH WESTERN UTILISATION GROUP : Engineers' Club, Albert Square, Manchester, "Electrical Characteristics of the Argon Arc Welding Process," J. C. Needham and L. H. Orton, 6.15 p.m. ★ SOUTHERN CENTRE : The University, Southampton, "F.M./A.M. V.H.F. Portable Transistor Receivers," L. E. Jansson, 6.30 p.m.

Wed., Dec. 7.—CHATHAM DISTRICT GRADUATE AND STUDENT SECTION : Medway College of Technology, Chatham, Kent, "Magnetic Amplifiers in Power Engineering," M. J. Pope, 7 p.m. ★ LONDON GRADUATE AND STUDENT SECTION : Visit to B.B.C. Lime Grove Studios, 2.30 p.m. ★ TEES-SIDE SUB-CENTRE : Cleveland Scientific and Technical Institution, Middlesbrough, "The Logmotor—A Cylindrical Brushless Variable-Speed Induction Motor," F. C. Williams, E. R. Laithwaite, J. F. Eastham and L. S. Piggott, and "Brushless Variable-Speed Induction Motors using Phase-Shift Control," F. C. Williams, E. R. Laithwaite, J. F. Eastham and W. Farrer, 6.30 p.m. ★ NORTH-WESTERN ELECTRONICS AND COMMUNICATIONS GROUP : Engineers' Club, Manchester, Discussion on "New Semi-conductor Devices," opened by A. A. Shepherd, 6.15 p.m. ★ SOUTHERN CENTRE : S.E. Electricity Board Office, 10, Queens Gardens, Hove, "Radiocommunication in the Power Industry," E. H. Cox and R. E. Martin, 6.30 p.m.

Thurs., Dec. 8.—UTILISATION SECTION : Savoy Place, London, W.C.2, "The Determination of the Electrical Characteristics of an Arc Furnace," J. Ravenscroft, 5.30 p.m. ★ CAMBRIDGE ELECTRONICS AND MEASUREMENT GROUP : Cavendish Laboratory, Cambridge, "Recent Progress in Microwave Valves," A. H. W. Beck, 8 p.m. ★ NORTH SCOTLAND SUB-CENTRE : Electrical Engineering Dept., Queen's College, Dundee, "Induction Generators for Electricity Supply," C. L. C. Allan, 7 p.m. ★ WEST WALES (SWANSEA) SUB-CENTRE : Conference Room, S. Wales Electricity Board, The Kingsway, Swansea, Informal Meeting, 6 p.m.

INSTITUTION OF ENGINEERING DESIGNERS

Mon., Dec. 5.—NORTH-EAST BRANCH : New Lecture Theatre, Rutherford College of Technology, Northumberland Road, Newcastle upon Tyne, 1, "Inventions, Patents and the Engineer," C. P. MacCarthy, 7.15 p.m. ★ NORTH STAFFORDSHIRE BRANCH : North Staffordshire Technical College, Stoke-on-Trent, "Electronic Computers," J. Boothroyd, 7.15 p.m.

INSTITUTION OF HIGHWAY ENGINEERS

To-day, Dec. 2.—LONDON BRANCH : Institution of Structural Engineers, 11, Upper Belgrave Street, London, S.W.1, "Lessons Learned on the Design and Construction of Motorways—(ii) From the Consultant's Angle," R. F. Earley, 5.30 p.m. ★ NORTH EASTERN BRANCH : Appleby Theatre, University of Durham Science Laboratories, South Road, Durham City, "High Design," W. S. Hydes and A. W. Jacomb, 7 p.m.

INSTITUTION OF LOCOMOTIVE ENGINEERS

Tues., Dec. 6.—Institution of Mechanical Engineers, 1, Birdcage Walk, London, S.W.1, "Rheostatic Braking for Multiple-Unit Trains," J. H. Cansdale, and G. Collins, 5.30 p.m.

INSTITUTION OF MECHANICAL ENGINEERS

To-day, Dec. 2.—EASTERN GRADUATES' SECTION : College of Further Education, High Wycombe, Film Show 7.30 p.m.

Mon., Dec. 5.—NORTH EASTERN BRANCH : Neville Hall, Westgate Road, Newcastle upon Tyne, "The Diesel Engine in Association with the Gas Turbine," E. Chatterton, 6 p.m.

Tues., Dec. 6.—COVENTRY A.D. CENTRE : Groveneor Room, Leofric Hotel, Coventry, Crompton-Lanchester Lecture, "Suspension, Steering and Tyres," D. Bastow, 7.15 p.m. ★ EASTERN GRADUATES' SECTION : Visit to Armco, Ltd., Letchworth, 7.30 p.m. ★ NORTH WESTERN A.D. CENTRE : Engineers' Club, Manchester, "The Successors to the Steam Locomotive," L. F. R. Fell, 7.15 p.m.

Wed., Dec. 7.—I, Birdcage Walk, Westminster, London, S.W.1, Symposium on "The Dounreay Fast Reactor," 6 p.m. ★ YORKSHIRE BRANCH : The University, St. George's Square, Sheffield, "The Design and Construction of a Goliath Crane for Bradwell Nuclear Power Station," J. Baker, 7.30 p.m. ★ EAST MIDLANDS GRADUATES' SECTION : College of Further Education, Nun's Corner, Grimsby, "Stress Analysis of Diesel Engine Components," S. A. Hasan, 7.15 p.m. ★ NORTH WESTERN GRADUATES' SECTION : Engineers' Club, Albert Square, Manchester, "Some Applications of Shot Blasting," J. Bradshaw, 7 p.m.

Thurs., Dec. 8.—EAST MIDLANDS BRANCH : Room 42, Midland Hotel, Derby, "Advanced Developments in the Design of Diesel Engines," R. J. Dain, 7.30 p.m. ★ SOUTH WALES BRANCH : Engineering Laboratories, The University, Bristol, "General Descriptions of Automatic Control in Industry," A. L. Stuchbery, 6.30 p.m. ★ DERBY A.D. CENTRE : Midland Hotel, Derby, "Advanced Developments in the Design of Diesel Engines," R. J. Dain, 7.30 p.m. ★ EAST MIDLANDS GRADUATES' SECTION : Visit to Central Ordnance Depot, R.E.M.E., Chilwell, Nottingham, 2 p.m. ★ EASTERN BRANCH : Sun Hotel, Hitchin, Herts., "Performance Measurement of the Complete Car," A. Fogg, presented by M. R. Hayes, 7.30 p.m.

INSTITUTION OF PLANT ENGINEERS

Tues., Dec. 6.—LONDON BRANCH : Royal Society of Arts, John Adam Street, Adelphi, Strand, London, W.C.2, "Civil Engineering Problems in Tall Buildings," Sir Thomas P. Bennett, 7 p.m.

Tues., Dec. 6.—PETERBOROUGH BRANCH : White Lion Hotel, Church Street, Peterborough, "Some Engineering Problems with Chemical Plant," J. C. Veale, 7.30 p.m.

Wed., Dec. 7.—BIRMINGHAM BRANCH : Hotel Leofric, Coventry, "Paint Spraying," 7.30 p.m. ★ EDINBURGH BRANCH : Kasroc Hotel, Castle Terrace, Edinburgh, Informal meeting, 7 p.m. ★ SOUTHERN BRANCH : Polygon Hotel, Southampton. "Treatment of Industrial Effluents," 7.30 p.m.

Thurs., Dec. 8.—GLASGOW BRANCH : Scottish Building Centre, 425, Sauchiehall Street, Glasgow, C.2, Open Forum, 7.15 p.m. ★ NORTH EAST BRANCH : Roadway House, Oxford Street, Newcastle upon Tyne, 1, "Fine Measurement," J. B. Adams, 7 p.m.

INSTITUTION OF PRODUCTION ENGINEERS

Tues., Dec. 6.—EAST AND WEST RIDINGS REGION : Percival Whitley College of Further Education, Francis Street, Halifax, "The Function of Modern Inspection," A. C. J. Surman, 7.30 p.m. ★ SOUTHERN REGION : College of Further Education, Cleveland Avenue, Darlington, "The Meaning of Effective Communication in an Industrial Organisation," A. C. Leyton, 7 p.m. ★ NORTH MIDLANDS REGION : White Lion Hotel, Church Street, Peterborough, "Chemical Engineering," J. C. Veale, 7.30 p.m. ★ SOUTHERN REGION : Town Hall, Oxford, "Non-Destructive Testing as an Aid to Production," D. G. W. Claydon, 7.30 p.m.

Wed., Dec. 7.—NORTH MIDLANDS REGION : Reform Club, Victoria Street, Nottingham, "The Production of Engineering Components from Metal Powder," J. W. Lennox, 7 p.m. ★ SOUTH EASTERN REGION : College Lecture Theatre, Municipal College, Dept. of Engineering, Victoria Circus, Southend-on-Sea, "Budgetary Control as an Aid to Works Management," A. G. Raven, 7.30 p.m. ★ SOUTH WESTERN REGION : Cornwall Technical College, Trevenson, Pool, Redruth, "Process Variability and its Control," C. S. Smith, 7.15 p.m.

INSTITUTION OF THE RUBBER INDUSTRY

Mon., Dec. 5.—BURTON-ON-TRENT SECTION : Midland Hotel, Station Street, Burton-on-Trent, "Modern Methods in Compounding Neoprene," A. Fiber, 7.30 p.m. ★ NORTH EASTERN SECTION : Eldon Grill, Newcastle, "Footwear," F. Baynes, 7 p.m. ★ SOUTH WALES AND MONMOUTHSHIRE SECTION : Queens Hotel. Newport "Chemical Resistance of Rubbers and Plastics," B. J. Habgood, 7.30 p.m.

Tues., Dec. 6.—LEICESTER SECTION : Royal Hotel, Leicester, "A Report on the Red Triangle Footwear Factory, and Other Impressions of a Visit to the U.S.S.R.," W. F. Watson, 7.30 p.m.

Thurs., Dec. 8.—HUMBERSIDE SECTION : Yarborough Hotel, New Holland, "Planning a Quality Control Department," M. A. Simmons, 8 p.m.

INSTITUTION OF STRUCTURAL ENGINEERS

To-day, Dec. 2.—WESTERN COUNTIES BRANCH : Small Lecture Theatre, University Engineering Laboratories, University Walk, Bristol, 8, "The Characteristics of Friction Grip Bolt Joints," M. S. G. Cullimore, 6 p.m.

Tues., Dec. 6.—NORTHERN COUNTIES BRANCH : City Hall, Newcastle, "Man and Moloch," J. R. T. Gibson Jarvie, 7 p.m. ★ NORTHERN COUNTIES BRANCH : Cleveland Scientific and Technical Institution, Middlesbrough, "Clifton Bridge, Nottingham," J. C. Adamson and A. Goldstein, 6.30 p.m. ★ NORTHERN IRELAND BRANCH : Civil Engineering Department, David Keir Building, Queen's University, Belfast, "Lift Slab Construction," F. R. Benson, 6.30 p.m. ★ WALES AND MONMOUTHSHIRE BRANCH : Mackworth Hotel, High Street, Swansea, "Brazil, Venezuela and Mexico," A. J. Gordon, 6.30 p.m.

Wed., Dec. 7.—MIDLAND COUNTIES BRANCH : East Midlands Electricity Board Showrooms, Irongate, Derby, "Concepts of Structural Safety," R. C. Coates, 6.15 p.m. ★ NORTHERN COUNTIES BRANCH : Neville Hall, Newcastle, "Clifton Bridge, Nottingham," J. C. Adamson and A. Goldstein, 6.30 p.m. ★ SCOTTISH BRANCH : North British Hotel, Edinburgh, "Zambesi Hydro Electric Development at Kariba—First Stage," T. A. L. Paton and C. E. Blackburn, 6 p.m. ★ SOUTH-WESTERN COUNTIES SECTION : Scott Memorial Theatre, Plymouth, "Tamar Suspension Bridge," 10.30 a.m. followed by a site visit, 2 p.m. ★ YORKSHIRE BRANCH : Royal Victoria Hotel, Sheffield, "Recent Prestressed Concrete Work in North America and the Commonwealth," D. H. Lee, 6.30 p.m.

Thurs., Dec. 8.—LONDON BRANCH : 11, Upper Belgrave Street, London, S.W.1, "The Structural Engineer in the Coal Industry," C. A. C. Davies, 6 p.m. ★ LANCASHIRE AND CHESHIRE BRANCH : College of Science and Technology, Manchester, "The Runcorn/Widnes Project," J. K. Anderson, 6.30 p.m.

IRON AND STEEL INSTITUTE

To-day, Dec. 2.—Hoare Memorial Hall, Church House, Great Smith Street, London, S.W.1, Symposium on "Steels for Reactor Pressure Circuits," 9.30 a.m.

JUNIOR INSTITUTION OF ENGINEERS

To-day, Dec. 2.—Pepys House, 14, Rochester Row, Westminster, London, S.W.1, Films, "Dounreay Fast Reactor," "More for Your Money," and "Isotopes in Industry," 7 p.m.

NEWCOMEN SOCIETY

Wed., Dec. 7.—Science Museum, South Kensington, London, S.W.7, "The Horse as a Source of Rotary Power," F. Atkinson, 5.30 p.m.

ROYAL AERONAUTICAL SOCIETY

Tues., Dec. 6.—ASTRONAUTICS AND GUIDED FLIGHT SECTION : Library, 4, Hamilton Place, London, W.1, "Solid Propellant Rocket Motors," G. H. S. Young and W. R. Maxwell, 6 p.m.

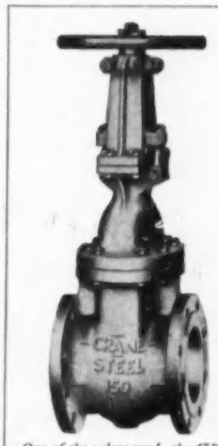
ROYAL SOCIETY OF ARTS

Tues., Dec. 6.—6, John Adam Street, Adelphi, London, W.C.2, Joint meeting with the Institution of Plant Engineers, "The Architect's Approach to Engineering in Tall Buildings," Sir Thomas Bennett, 6.30 p.m.

ONCE AGAIN VALVES BY CRANE

The new plant of The International Synthetic Rubber Company Ltd. at Hythe on Southampton Water is now in production in a big way. Once again Crane valves are playing an important part. The illustration *left* shows the recovery building, where the steam lines to the Styrene Strippers have been fitted with Crane 12 inch, 10 inch and 6 inch cast steel gate valves. In the administrative buildings too, Crane equipment is used, the central heating and domestic installations being very largely fitted with Crane Bronze Globe and Gate Valves. More and more industries are discovering that the name of Crane is synonymous with dependability.

INSTALLING ENGINEERS:
Matthew Hall & Co. Ltd., London



One of the valves used—the 47X in cast steel, with end connections to British as well as American Standards. Can be trimmed to suit a variety of services for high and low pressures and temperatures.

D30

CRANE

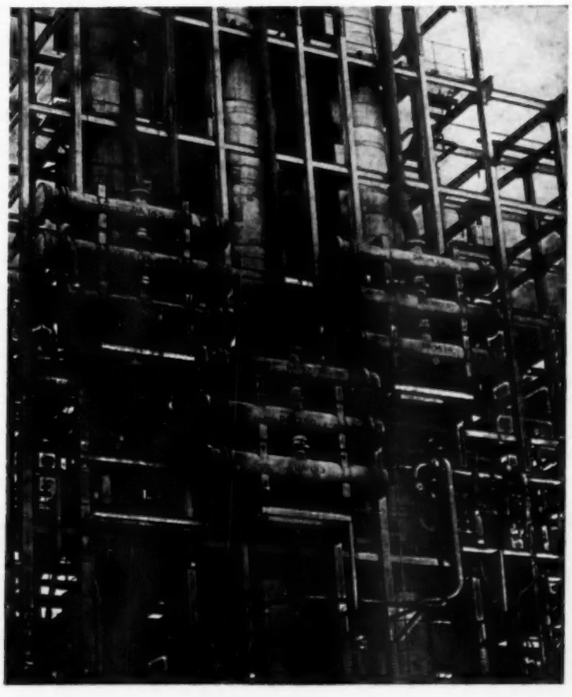
VALVES OF BRONZE, CAST IRON & STEEL

CRANE LTD., 15-16 RED LION COURT, FLEET STREET, LONDON, E.C.4. WORKS: IPSWICH *Branches: Birmingham, Brentford, Bristol, Glasgow, Leeds, London, Manchester*

Enter No. 731 on reply card

Wm. NEILL & SON

(ST. HELENS) LTD.



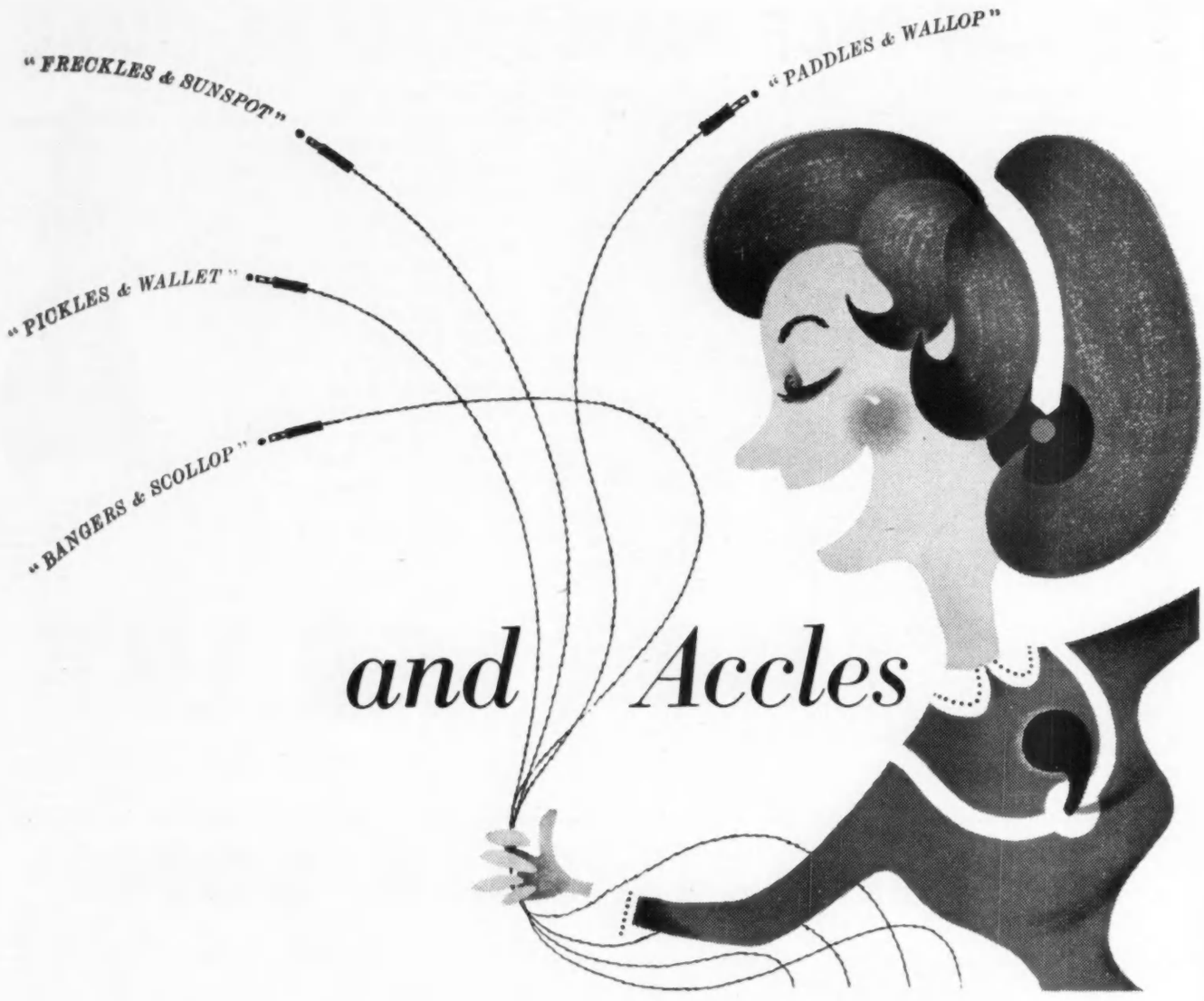
HEAT EXCHANGERS AND FRACTIONATING COLUMNS

manufactured and erected to customers' individual requirements.

BOLD IRON WORKS
St. Helens Junction, Lancs.
Tel: ST. HELENS 7363
London Office: 38 VICTORIA STREET, S.W.1
Tel: ABBEY 5343

NEILL'S FABRICATE STEEL

Enter No. 732 on reply card



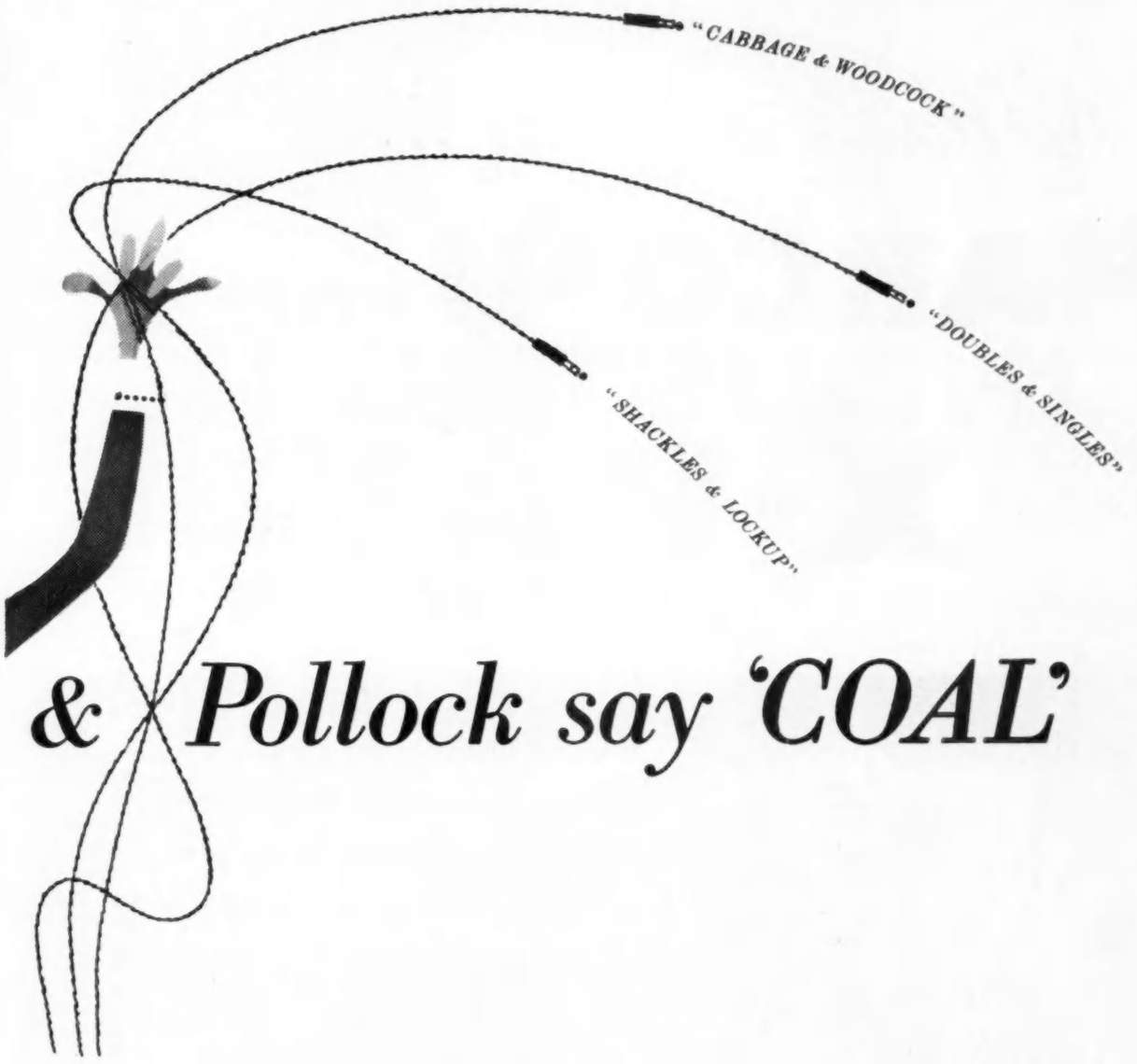
TO CHANGE a lump of stainless steel into a tiny tube ·011/·0115" o/d x ·005/·007" i/d, used for the manufacture of automatic knitting needles in the textile industry, is only one of the many miracles that Accles & Pollock create for science and industry at their works at Oldbury, Birmingham.

Behind this brilliant engineering know-how that will design and produce tubes of any size, any complexity, is the direction and impetus of a dynamic management that secures long-term advantages as well as immediate gain when making decisions. That's why Accles and Pollock choose *coal* to keep their great boilerhouse at its efficiency peak. Their experience has proved that coal, mechanically stoked, *gives the maximum heat for the lowest cost:* and they know that there is no shortage of coal—the home produced fuel.

When the question of fuel for your factory is on the agenda, remember Accles & Pollock. Their choice is coal for a progressive and prosperous industry. Even if you get the name wrong, you get the decision right when you follow their example.

PROGRESSIVE INDUSTRY IS GOING

ISSUED BY THE NATIONAL COAL BOARD



& Pollock say 'COAL'

Mr. W. E. Powell, fuel engineer, comments: "Our boilers were designed, primarily, for burning the slack grading of solid fuel. Following experiments into ultimate economies, however, it was decided to change to the better fuel of the 'bean' grading. Under test, it was found that solid fuel gave us excellent combustion conditions, at a challenging price per thousand pounds of steam. By making use of modern mechanical means of firing, we are able to maintain strict control of operation practice.

The boilers are of the non-flue type, and when fitted with grit arresters, they satisfy all local and national regulations governing grit and smoke densities.

Most fuels can be controlled to give economical generation on the level obtained by solid fuel, but the use of coal does not entail the provision of ancillary equipment so necessary to the use of other heating mediums.

The present boilers have been in existence some ten to twelve years, and during that period, we have experimented with all available means towards obtaining the best from our equipment. All our tests bring us back to the use of the 'bean' size coal. Given this heating medium, the operators have no difficulty in maintaining the efficiency level nominated by us. That is why we shall continue to use coal at Accles and Pollock."

And here are some key facts and figures about the Accles & Pollock boilerhouse at Oldbury

Number of boilers	5 water tube
Steam pressure	120 lbs. per sq. inch
Steam temperature	340°F.
Continuous max. rating	55,000 lbs. per hour
Method of firing	Chain grate stokers
Annual fuel consumption	20,000 tons of coal

FORWARD ON COAL

Enter No. 751 on reply card

No doubt about it...

MARCONI FOR INDUSTRIAL X-RAY APPARATUS

Setting up a 250-kV Marconi Mobile X-ray apparatus for radiography of the longitudinal seam of an air receiver at the works of The North Eastern Marine Engineering Co. Ltd., Wallsend. (A member of the Richardsons, Westgarth group.)

THE MARCONI 250 kV CONSTANT POTENTIAL EQUIPMENT
is the natural choice of British Industry.
Users include:
Autodrome (Engineers) Ltd.
Babcock & Wilcox, Ltd.
John Brown Land Boilers, Ltd.
Distington Engineering Co., Ltd.
The English Electric Co., Ltd.
English Steel Corporation, Ltd.
W. J. Frazer, Ltd.
D. Napier & Son, Ltd.
The North Eastern Marine Engineering Co., Ltd.
Redheugh Iron & Steel Co., Ltd.
A. Reyrolle & Co., Ltd.
Rolls Royce, Ltd.
Sheffield College of Technology
United Kingdom Atomic Energy Authority
Vickers Armstrong (Engineers) Ltd.
C. & W. Walker, Ltd.

The Marconi 250-kV Industrial X-Ray Unit offers every feature desired by the discriminating industrial physicist and radiographer. Completely British made, including insert, it is widely used in a number of industries, including shipbuilding, aircraft, iron and steel, motors, boiler-making and heavy electrical engineering. For full details of this versatile equipment, send for leaflet AJ24.

MARCONI *for X-Ray*

Please address enquiries to MARCONI INSTRUMENTS LTD. at your nearest office:

London and the South:
English Electric House, Strand, London, W.C.2
Telephone: COVent Garden 1234

Midlands:
Marconi House, 24 The Parade, Leamington Spa
Telephone: 1408

North:
23/25 Station Square, Harrogate
Telephone: 67455

Export Department:
St, Albans, Herts.
Telephone: St. Albans 59292

DQ4

Enter No. 761 on reply card

Not long ago, many people thought it impossible to get D.C. motors quickly and at a reasonable price. Some people still think so.

They don't know about E.P.E.

E.P.E. specialise in D.C. equipment, combining their many years experience in this field with a keen interest in new techniques. They can supply D.C. motors and generators of any enclosure quickly and at a reasonable price.

If you've a D.C. motor problem, why not bring it along to E.P.E ? If they haven't a solution in stock, they'll be happy to make one for you !

E·P·E

ELECTRICAL POWER ENGINEERING CO. (B'ham) LTD.
Bromford Lane, Birmingham 8
'Phone : STEchford 2261
'Grams : Torque 'Phone Birmingham
London Office : 421, Grand Buildings, Trafalgar Square, W.C.2. 'Phone : Whitehall 5643 and 7962

Enter No. 771 on reply card

Enter No. 772 on reply card

Harvey & Longstaffe Ltd

Sand Casting Specialists in

MANGANESE BRONZE

ALUMINIUM BRONZE

HIGH CONDUCTIVITY COPPER

HIGH STRENGTH ALUMINIUM ALLOYS

Send your enquiries to the firm at the top

Head Office and Foundry
PIERCY STREET. ANCOATS, MANCHESTER, 4.
Tel: No. COLlyhurst 1503/4

Enter No. 773 on reply card

1610

The No. 1610 Safety Valves are included in our extensive range of Valves, Cocks and Allied fittings, details of which are given in our new 150 page Catalogue.

ROBERT HARLOW & SON, LIMITED.

HEATON NORRIS • STOCKPORT • CHESHIRE

TELEPHONE : STOckport 3403/4/5

LONDON OFFICE : 10 NORFOLK ST., W.C.2. TELEPHONE : COVent Garden 0315/6/7 CW.2791

Enter No. 781 on reply card

Moulding Tools by Specialists

POLYTHENE WATERING CAN BODY MOULD *Part of set of three producing complete article.*

H. B. SALE LTD

PROGRESS WORKS, SUMMER LANE, BIRMINGHAM

Telephone : CEN 5661-3 Grams : SALE, BIRMINGHAM

Established 1862

Enter No. 782 on reply card

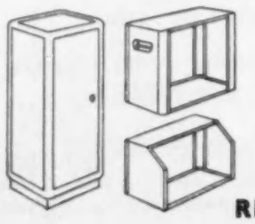
You make it

Instrument cabinets and equipment racks in formed steel sections are Ritherdon's speciality. Made-to-measure for housing communications, control, and instrument equipment, these cabinets are all constructed on a 'Standard' system whatever the specified shape or size. Units of basic but flexible design (some examples are illustrated) can be constructed to meet your particular specifications at a price comparable with batch production costs. Ritherdon's method of construction saves design time and avoids the long delays and high costs of housing non-standard equipment.

Write or telephone us for further details

Enter No. 783 on reply card

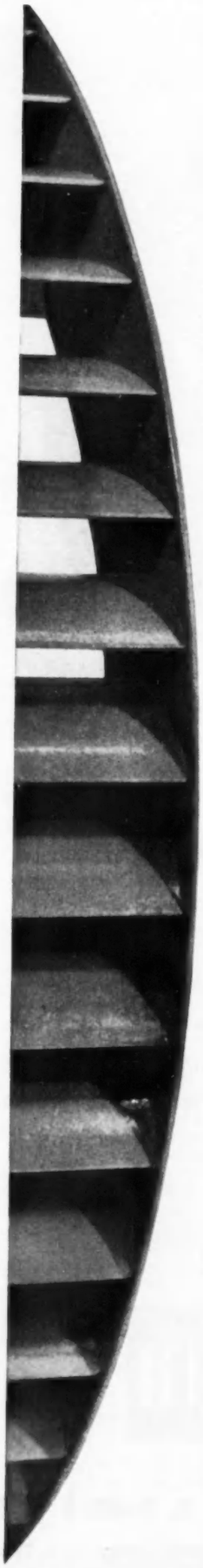
— we'll case it!



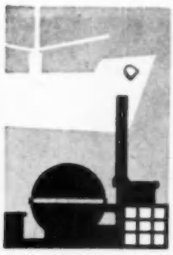
MADE-TO-MEASURE INSTRUMENT and EQUIPMENT HOUSINGS AT ECONOMICAL COSTS.

ALPHADON SHEET METAL WORK BY RITHERDON & CO LTD DARWEN

RITHERDON & CO LTD · DARWEN · LANCS · Telephone : DARWEN 1028



formula for leadership



Experience Founded originally in 1823 the Company has had the widest experience in the design and manufacture of all types of equipment for the handling of air and other gases. Blowers, exhausters, heaters, filters, dust and fume removal equipment, and of course, fans of all types, fall within this wide scope. Fans of every size and for every purpose, from Coal Mines to Aircraft Carriers, have been designed, manufactured and tested by Keith Blackman and installed in all parts of the world—experience unparalleled in the field.

Research Keith Blackman's lead in design is maintained by five separate research departments. Specialised facilities are available at Tottenham for the development and testing of axial fans, centrifugal fans and filtration equipment, while a metallurgical laboratory controls the quality of materials founded at Arbroath. Tottenham also possesses one of the most advanced acoustics laboratories in the world for the investigation of sound levels in all types of fan engineering equipment.
In addition, the company's generating station, as well as supplying power to the factory, is designed to produce a wide range of A.C. and D.C. supplies for the test beds.

Range The Keith Blackman range covers virtually every type of fan and blower in all sizes—axial types from 5 inch to 100 inch diameter, centrifugal types ranging from 1¼ inch to 180 inch, and propeller fans from 6 inch to 72 inch diameter. Much equipment is designed for clients' specific requirements involving, frequently, the use of special materials including pvc. Other equipment is made for heating, cooling, washing, dust and fume extraction, filtration and air conditioning. *Five thousand fans of varying types are kept continuously in stock for quick delivery.*

Keith Blackman Ltd
(Incorporating Blackman Export Co. Ltd.)
MILL MEAD ROAD, LONDON N.17 TOTTENHAM 4522

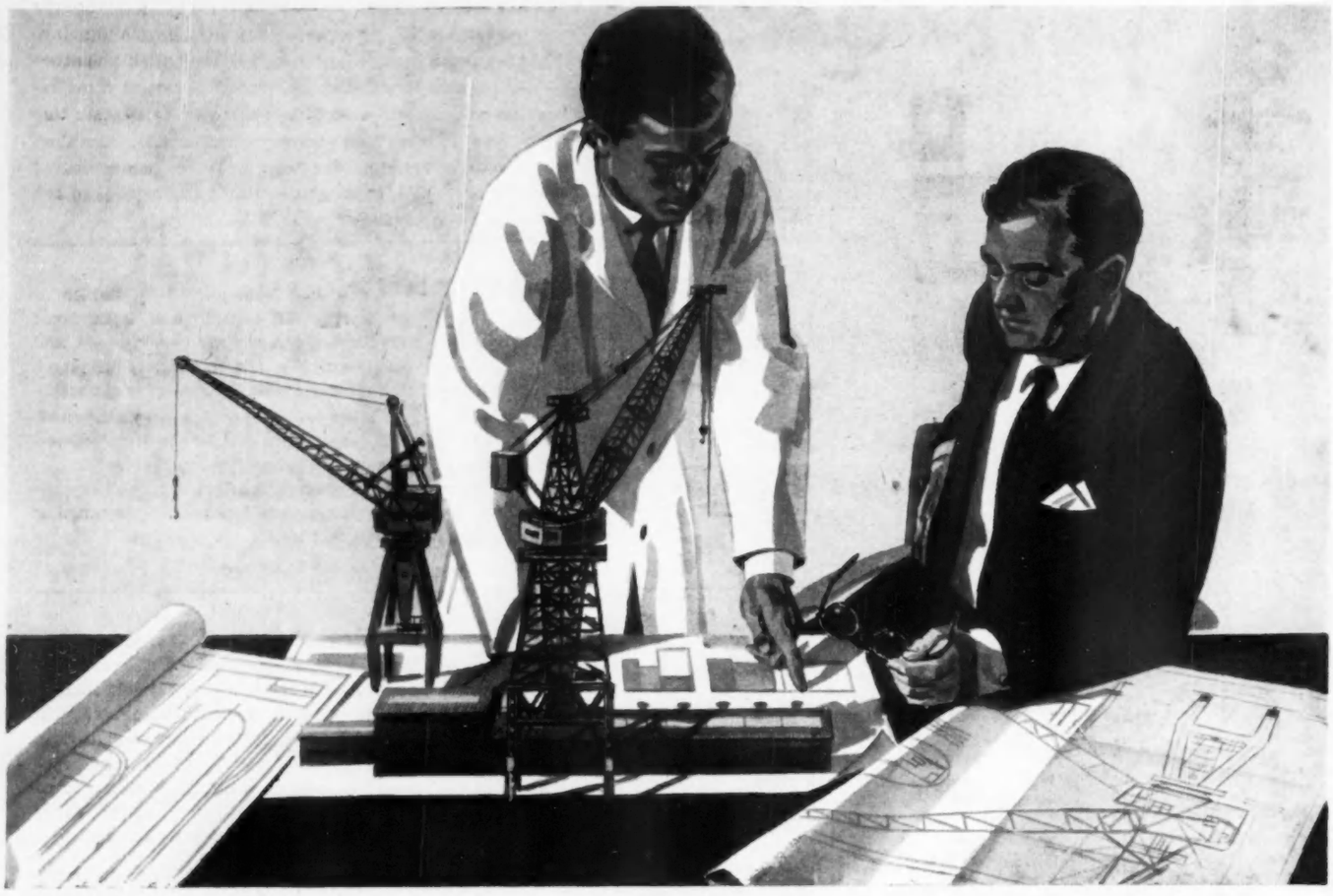
Leaders in the Fan Industry

Resources The company's three factories cover an area of 17¼ acres, and employ over 1,800 people. The main Tottenham works produces small and medium units and includes drawing offices, test facilities and machine shops, as well as the sales and administration offices. The Arbroath works deals with the production of the larger fans. Its iron and non-ferrous foundry plant supplies the whole of the company's casting needs. The Edmonton Factory concentrates on light sheet metal and plate work and the fabrication of steel structures. Virtually all components, including fan motors and bearing housings, are thus designed and manufactured within the organisation—a unique combination of resources.

Service Through the years the company has built up an enviable reputation for service at all stages.
Sales representatives are all fully trained technical men capable of giving 'on the spot' advice on routine applications or special problems. The sales organisation operates from branches throughout the country backed by a staff of qualified sales engineers at Head Office. Despatch of stock items, of which 5,000 units are kept continuously available, is possible in as little as four days. The Company has its own road transport fleet and direct rail connections from the main factory.

TA 2661/1059

Enter No. 791 on reply card



MODERNISING?

...the first consideration is craneage

At shipyards throughout Britain the post-war years have seen a quiet revolution in construction capacity. Many millions have already been invested in the reorganisation and modernisation of production methods. With the prospect of the laying down of further important new ships a new impetus has been given to this ambitious programme, designed to keep Britain in the forefront of marine engineering developments.

Craneage to cope with new techniques of unit prefabrication is a major requirement of any modernisation programme. Clyde-Booth's specialised experience in this field is at your disposal from the initial planning stage.

- SHIPBUILDING CRANES
- SHIP REPAIR CRANES
- DOCKSIDE CARGO & GRABBING CRANES
- OVERHEAD TRAVELLING CRANES
- GOLIATH CRANES
- MECHANICAL HANDLING CRANES & KINDRED EQUIPMENT.

shipyard modernisation begins with CLYDE BOOTH

Please write for new 52 page catalogue to:

CLYDE CRANE AND BOOTH LIMITED

Incorporating **Joseph Booth & Bros., Union Crane Works, RODLEY, Leeds. Tel: Pudsey 3168 (6 lines). Grams: 'Cranes Rodley Telex'. Telex 55159**
Clyde Crane & Engineering Co., MOSSEND, Lanarkshire. Tel: Holytown 412 (6 lines). Grams: 'Clyde Motherwell Telex'. Telex 77443
M2

Enter No. 801 on reply card

A QUICK WAY

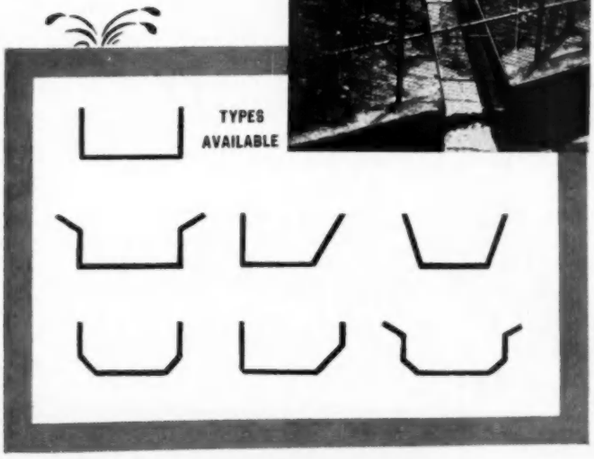
to get rid of water

The problem of draining underground and surface workings may be solved quickly and efficiently by the use of Harvey Pressed Steel Gutters. Available in lengths up to 12 ft., which are simply bolted together, Harvey Gutters enable long runs of continuous channel to be assembled with the minimum of labour.

Stoutly constructed in mild steel plate, in various sections and to any girth, the gutters can be supplied complete with angle pieces, stop ends, outlet units, etc., as required. Please ask for literature.

Water pumped from lower level to main sump through Box Gutters at an Iron Ore Mine in Glamorgan. Below: Continuation towards outfall.

460 ft. length Box Gutter leads water to nearest stream, preventing seepage to underground workings.



HARVEY

PRESSED STEEL GUTTERS

G. A. HARVEY & CO. (LONDON) LTD.
Woolwich Road, London, S.E.7. GREenwich 3232 (22 lines)

Other Harvey Products: HIGH CARBON STEEL WIRE SCREENS MACHINERY GUARDS • PERFORATED MILD STEEL CABLE TRAYS PERFORATED SCREEN PLATES • STEEL PLATE & SHEET METALWORK WIREWORK • WOVEN WIRE IN ALL METALS LF/17

Enter No. 811 on reply card

K

Cast Basalt

is the material best resisting abrasion and corrosion.

Installations with applied basalt castings are indispensable for conduits transporting hard and coarse materials such as coal, coke, ashes, clinker, ore, cement etc.

Cast basalt is more abrasion resisting than manganese steel,

it resists acids,

saves maintenance costs,

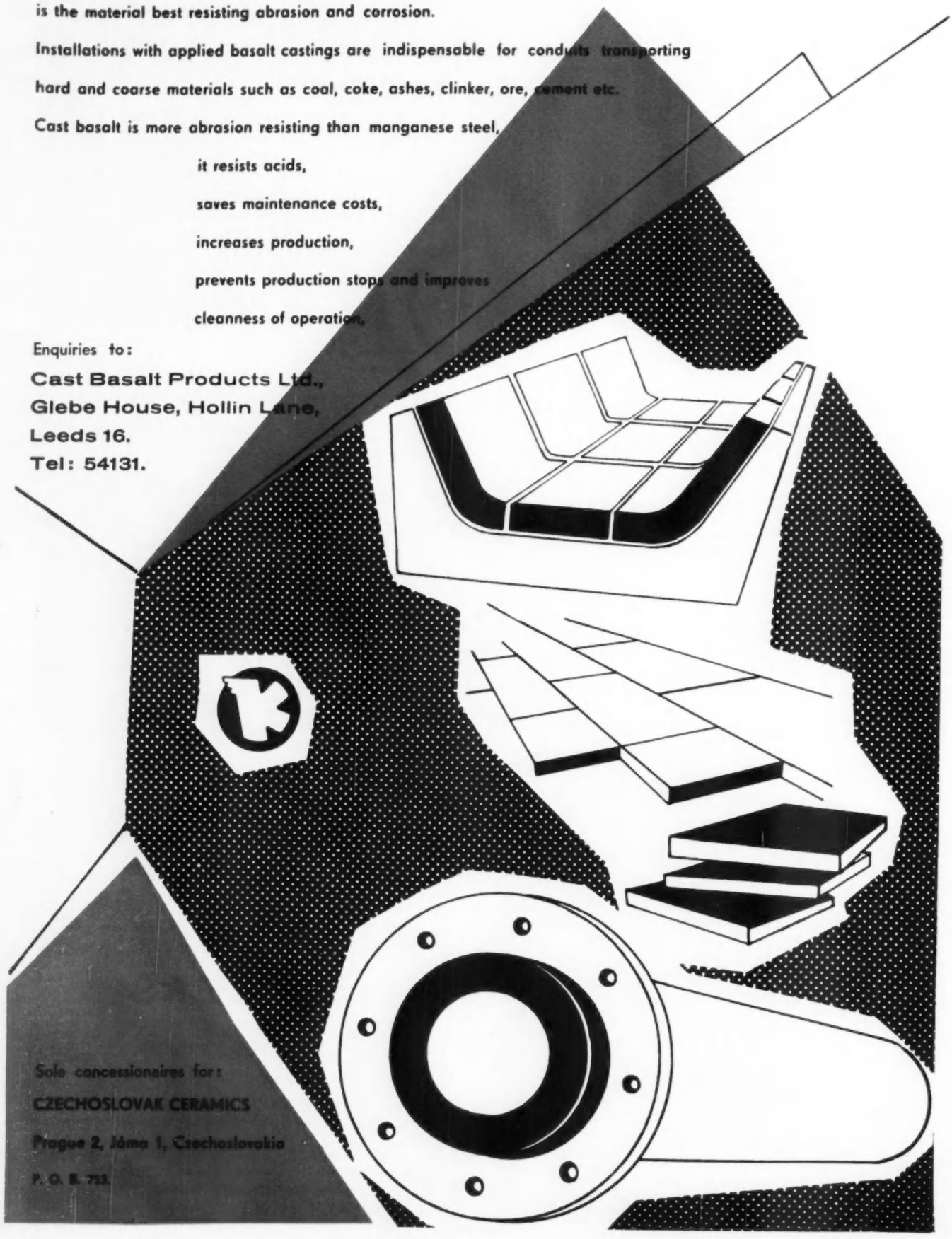
increases production,

prevents production stops and improves

cleanness of operation,

Enquiries to:

Cast Basalt Products Ltd.,
Glebe House, Hollin Lane,
Leeds 16.
Tel: 54131.



Sole concessionaires for:
CZECHOSLOVAK CERAMICS
Prague 2, Jáma 1, Czechoslovakia
P. O. B. 733

Enter No. 821 on reply card

cast in steel

to cut machining time by 78%

WITH INCREASED OUTPUT AND LESS MATERIAL WASTED

Before being made as a steel casting, production of this 2½" Valve involved prolonged machining and high material wastage. The change to casting, in nickel-chrome alloy steel, cut machining time by 78% and material wastage by 94%, giving much higher output at less cost. Have you considered taking advantage of the accurate, sound-quality castings obtainable, in any required composition, from modern steel foundries? Why not call in a steel foundry engineer at the design stage and use steel foundry know-how.

THE BRITISH STEEL FOUNDERS ASSOCIATION

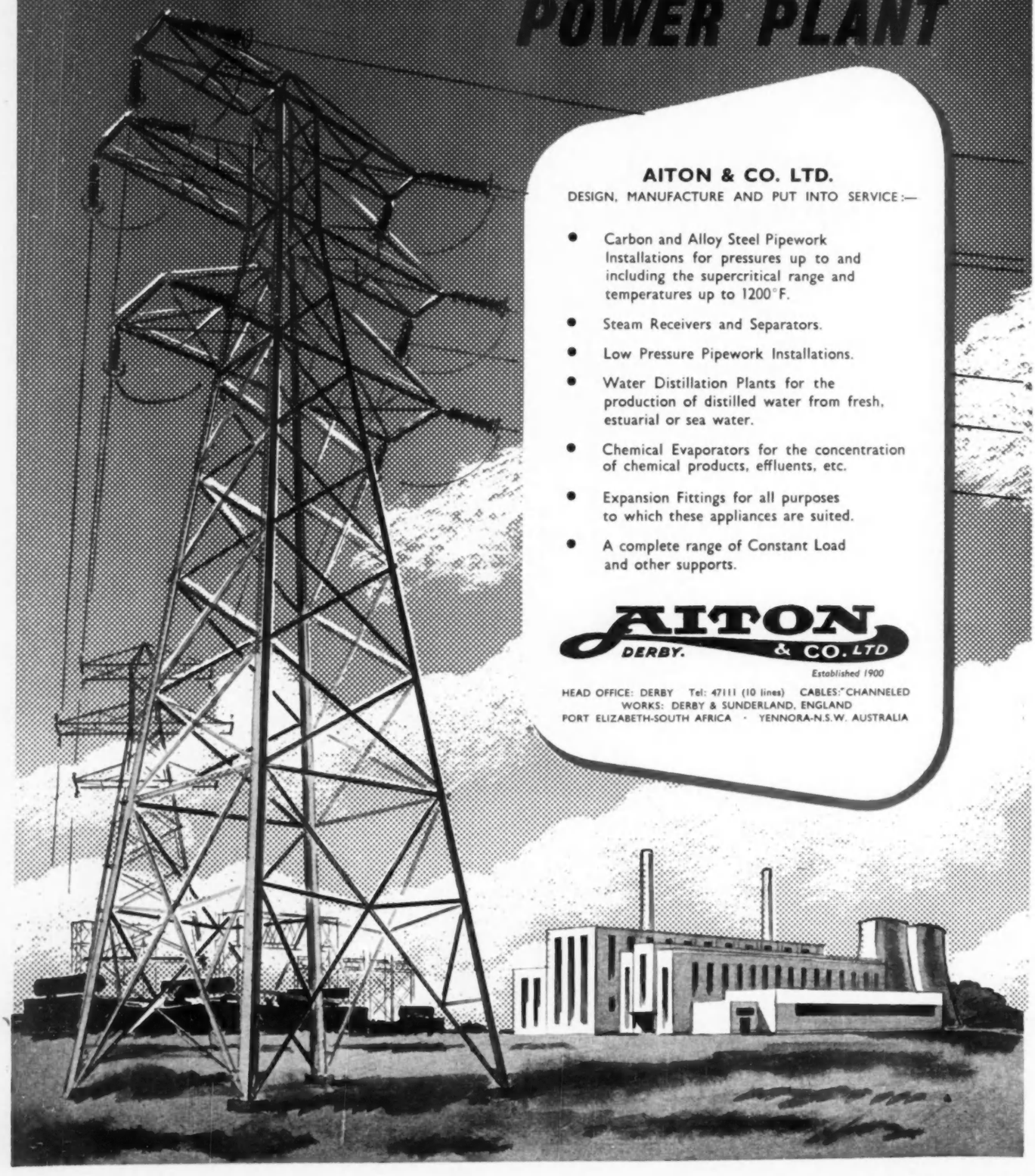
Broomgrove Lodge, Broomgrove Rd., Sheffield

BSFA STEEL CASTINGS

Enter No. 831 on reply card

Enter No. 821 on reply card

Specialised Pipework and Ancillary Equipment for POWER PLANT



AITON & CO. LTD.

DESIGN, MANUFACTURE AND PUT INTO SERVICE:—

- Carbon and Alloy Steel Pipework Installations for pressures up to and including the supercritical range and temperatures up to 1200°F.
- Steam Receivers and Separators.
- Low Pressure Pipework Installations.
- Water Distillation Plants for the production of distilled water from fresh, estuarial or sea water.
- Chemical Evaporators for the concentration of chemical products, effluents, etc.
- Expansion Fittings for all purposes to which these appliances are suited.
- A complete range of Constant Load and other supports.

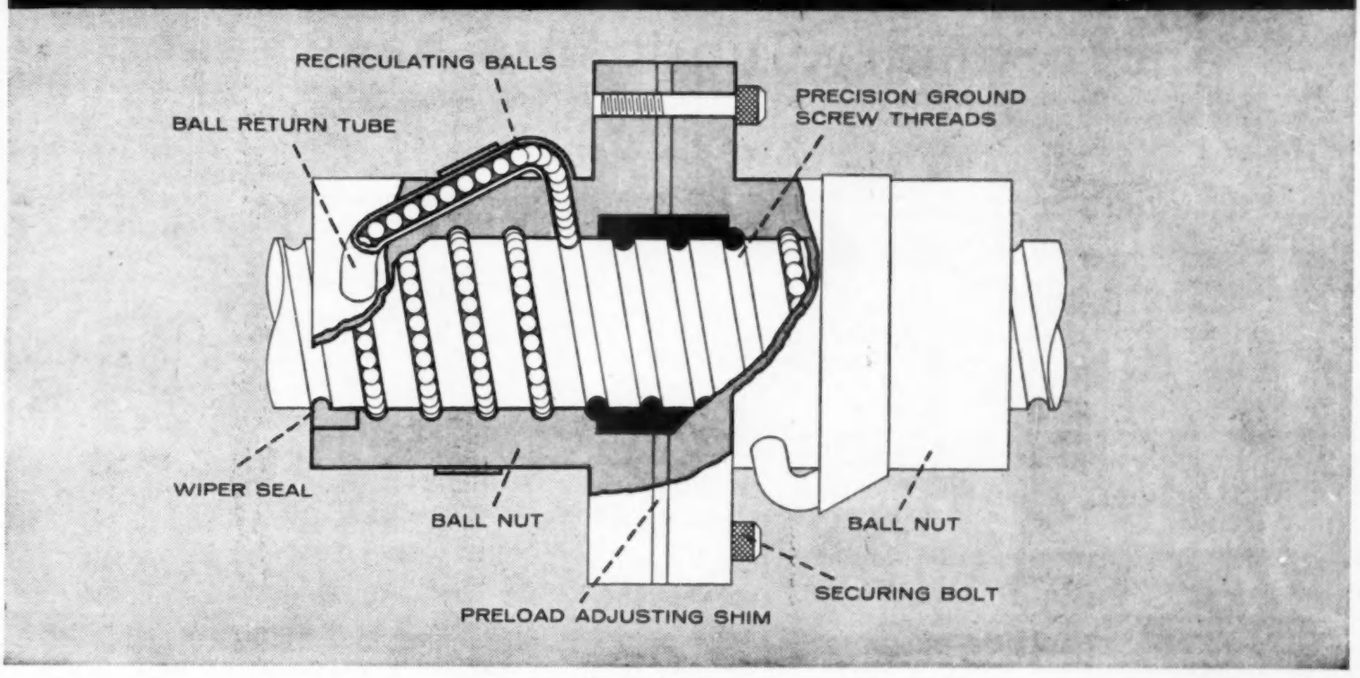
AITON DERBY. & CO. LTD

Established 1900

HEAD OFFICE: DERBY Tel: 47111 (10 lines) CABLES: "CHANNELED
WORKS: DERBY & SUNDERLAND, ENGLAND
PORT ELIZABETH-SOUTH AFRICA · YENNORA-N.S.W. AUSTRALIA

Enter No. 841 on reply card

Beaver pre-loaded ball screws, up to 95% efficient, operate at -52°C to over 400°C with no backlash...



...ANOTHER ENGINEERING ADVANCE FROM BRISTOL SIDDELEY

Bristol Siddeley Engines Limited produce Beaver* pre-loaded ball screws. These ball screws achieve a minimum efficiency of 90% and they can operate within a temperature range of —52° C to 400° C without lubrication, and up to 170° C when lubricated.

Machined and ground to the highest standards of precision engineering Beaver pre-loaded ball screws greatly increase transmission efficiency. They reduce the power required for actuation by as much as 80%, when converting rotary drive into linear output or force input into torque output. By eliminating backlash, with pre-loading, they give precise control over very small increments of motion and a high response frequency. And when compared to conventional screw mechanisms, they provide a predictable operating life which is much longer, require much less maintenance and give more trouble-free operation.

Basic design application analysis

Bristol Siddeley engineers make an exhaustive analysis of each specification. And each unit is specially designed for its particular application. Beaver ball screws are made automatically reversible or with controlled "no-back," with multiple or single circuits. Beaver pre-loaded ball screws have been proved as the most efficient method of converting rotary into linear thrust in over 2,700 engineering applications in many branches of industry. They have been designed already with rated operating load capacities of 370,000 lb (825,000 lb maximum static load) but the maximum potential operating load is, in most cases, limited only by the requirement.

Bristol Siddeley Beaver ball splines have been developed to eliminate the disadvantages of conventional splines. The designs are very effective in minimising friction, particularly when high torsional and bending loads are imposed during linear movement.

* *Complete technical and manufacturing co-operation with Beaver Precision Products Inc, Detroit.*

For further information please write to:

J. B. STARKY, SALES MANAGER (BALL SCREWS AND SPLINES), BRISTOL SIDDELEY ENGINES LIMITED, PO BOX 17, COVENTRY, ENGLAND.

BRISTOL SIDDELEY ENGINES LIMITED

Enter No. 851 on reply card

When hold-ups cost money...

... and ordinary lubricants have failed

ENGINEERS, GEARCUTTERS
MANUFACTURERS MERCHANTS
HOLMES
SAMUEL E. HOLMES LIMITED
BROOK WORKS
MONASTEREVAN
CO. KILDARE
Lubrication of Heavy Lathe Centres with MoS_2
Workpiece: 42" diameter Paper Mill Drying Cylinder weighing approximately 2½ tons, supported on 60 degree centres.
Problem: Each cut taken needed from 6½ to 8 hours. Various orthodox centre lubricants such as white-lead & oil, white-lead and graphite, grease & graphite, oil & graphite, etc., were tried. None of these were satisfactory. After about 40 minutes slight centre squealing began and after about one hour the job could not proceed without replenishing lubricant. To do this it was essential to support workpiece and wind out centre. In addition, damage occurred to centre, necessitating several removals for reconditioning.
As eight cylinders had to be machined, the above circumstances became quite intolerable.
Solution: A two-ounce tube of Rocol Anti-Scuffing Paste. When this lubricant was tried in accordance with the manufacturer's instructions it became possible to run the cylinder on centres for from 16 to 23 hours. In most cases, therefore, several cuts could be taken without interruption.
Conclusion: Only one two-ounce tube of Rocol Anti-Scuffing paste was needed for eight Cylinders. We regard this as a truly marvellous performance, and we are now using the paste as a standard centre lubricant for all kinds of work.
Director
March 1960
ANTI-SCUFFING PASTE
A Rocol PRODUCT

Rocol ANTI-SCUFFING PASTE

... is the answer!

ROCOL MOLYBDENISED LUBRICANTS

are manufactured by

ROCOL LIMITED, General Buildings, Aldwych, London, W.C.2 Tel. Holborn 1985
Rocol House, Swillington, Leeds. Tel. Garforth 2261

Enter No. 861 on reply ca

AIR CLEANSING . . .
THE TORNADO WAY

Mr. Manufacturer please do not allow your employees to work in conditions where air pollution exists.

Dirt costs time and money!

For a very reasonable outlay you can protect your staff from dangerous fumes, grit and dust, by using the :

TORNADO CLEAN AIR EQUIPMENT

Are you interested SIR ?

If so please phone at once and allow us to quote

Fully trained personnel are at your disposal.

BARNET METAL CO. LTD.

Elektron House, Brookhill Road, New Barnet, Herts.

Telephone : BARnet 3901/5187

Enter No. 871 on reply card

THE WORLD'S GREATEST BOOKSHOP

FOYLES

FOR BOOKS

FAMED CENTRE FOR

Technical Books

"That's what I call quick service—I telephoned Foyles at 10 a.m. and the book (although it was out-of-print) reached me by the next morning's post." —*A Customer's Letter*

FOYLES TRAVEL BUREAU

Write for details of Winter Sports Holidays. Amazing Value !

119-125 CHARING CROSS ROAD, LONDON, W.C.2

Gerrard 5660 (20 lines) ★ Open 9—6 (including Saturdays)

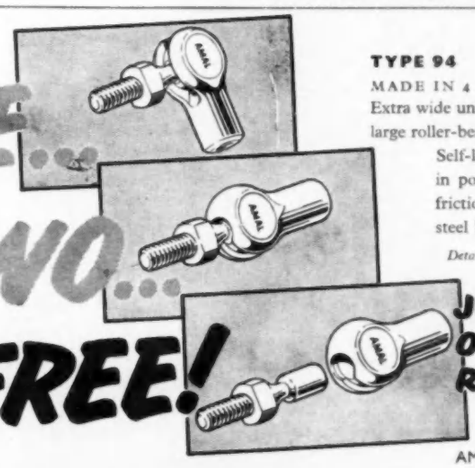
Two minutes from Tottenham Court Road Station

Enter No. 872 on reply card

ONE...

TWO...

FREE!



TYPE 94

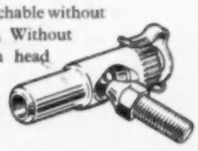
MADE IN 4 SIZES

Extra wide universal angular movement; Extra large roller-bearing surface in naval-brass bush; Self-locking, can only come apart when in position two ; Minimum play and friction; No springs; Cadmium plated steel body and tough steel pin.

Details of sizes can be supplied on request.

TYPE 81

Micrometer adjustment for wear or play; Instantly detachable without tools; Self-locking; Without spring pressure on head making for easy movement, without play; Brass body, steel headed pin.



JUST TWO SIMPLE MOVEMENTS COUPLE OR UNCOUPLE THESE ROBUST AND RELIABLE ROLLER JOINTS BY

AMAL

A187

AMAL LTD., HOLDFORD ROAD, WITTON, BIRMINGHAM 6. Tel. Birchfield 4571.

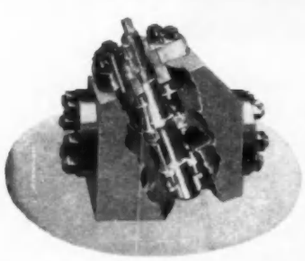
Enter No. 873 on reply card

LEH

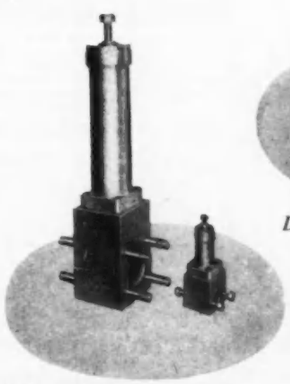
DESIGNERS AND MANUFACTURERS OF HYDRAULIC EQUIPMENT

Heavy Duty

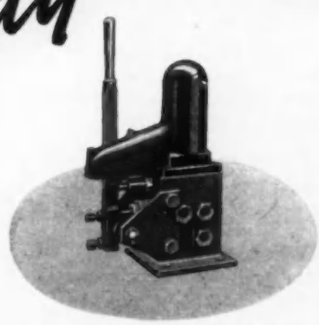
HYDRAULIC VALVES



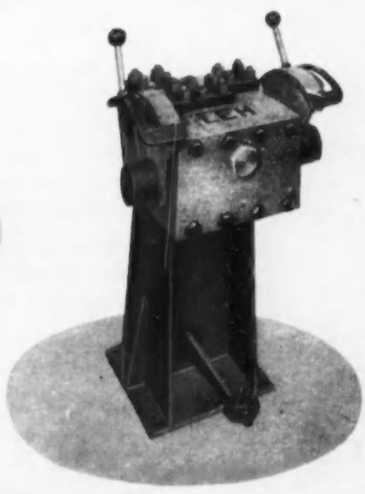
Balanced 'Inline' Stop Valve



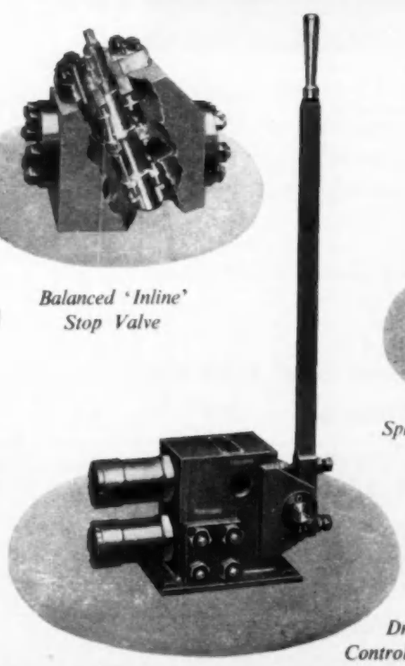
Spring Loaded Relief Valves



Drop Mitre Control Valve With Trip Gear



Piston Type Control Valve



Drop Mitre Control Valve

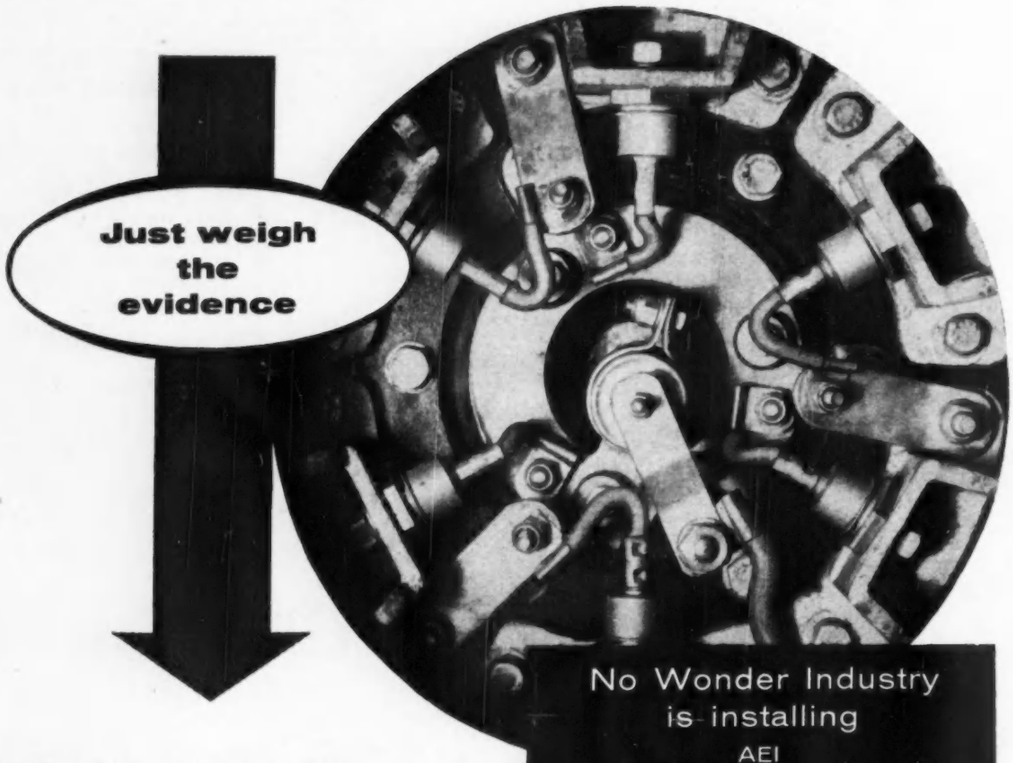
Of exceptionally robust construction, L.E.H. Valves are eminently suitable for the control of direct hydraulic power applications in heavy industry and wherever complete reliability under arduous conditions is of paramount importance.

THE LEEDS ENGINEERING & HYDRAULIC CO. LTD. RODLEY, LEEDS.

Telephone: 'Pudsey' 2859.
Telegrams: 'Pumps,' Rodley.
13

Enter No. 874 on reply card

The case for brushless is overwhelming!



No Wonder Industry is installing AEI BRUSHLESS A.C. GENERATORS

Maintenance costs cut dramatically . . . because there are *no* brushes to inspect or replace, *no* carbon brush dust to endanger insulation, *no* sliprings to be re-ground, *no* commutator to be skimmed.

Because sparking cannot occur fire risk is inherently low. AEI brushless A.C. generators are particularly useful for standby duty and for service in situations remote from grid supplies.

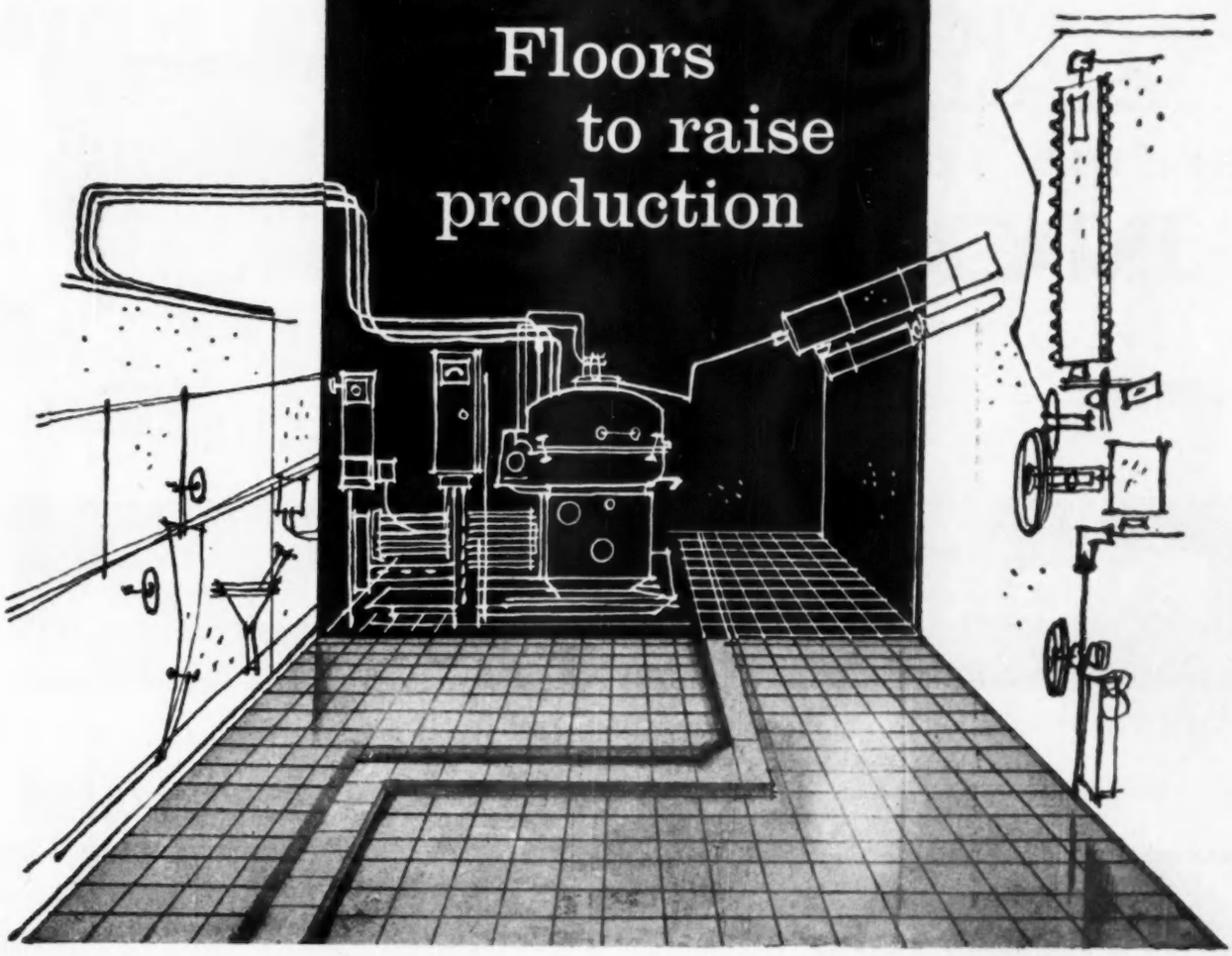
Write now for leaflet to:

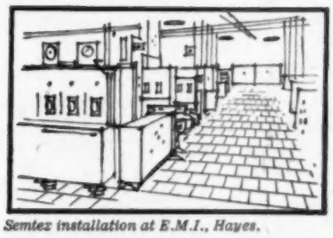
Despite all their advantages brushless A.C. generators cost no more than alternative equipment and are available in an extensive range from 50 kVA up to 5,000 kVA.

AEI **Associated Electrical Industries Limited**
Heavy Plant Division
RUGBY, ENGLAND
A5583
PLEASE HELP SPASTICS

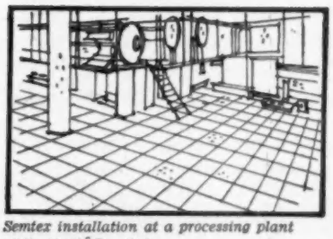
Enter No. 881 on reply card

Floors to raise production





Semtex installation at E.M.I., Hayes.



Semtex installation at a processing plant of the Nestlé Co., Ltd.

A Semtex installation at the Ellesmere Port Refinery of the Shell Chemical Company Limited.

The installation of practical, hard-wearing and corrosion resistant floors will save you time and money in putting an end to constant repairs and in improving your annual turnover by uninterrupted production. Semtex, specialists in all types of flooring, will take over your entire flooring operation, designing, transporting and laying materials which proof factory floors, storage bays and machine beds against corrosive agents and mechanical wear. Continued research into the special problems confronting industry has led Semtex to the fore in the manufacture of new materials and in the development of the most comprehensive flooring service in the business.
Get in touch with your consultant now—or write to the address below for further details.

MODERN INDUSTRIAL FLOORING

Semtex Ltd

SEMTEX LTD., 50 BLACKFRIARS ROAD, SALFORD 3, MANCHESTER. Tel: Deansgate 2128

Enter No. 891 on reply card

NOW!

HYDRAULIC CIRCUITS

HYDRAULIC A-Z

can be bought in a package!

THE ARMSTRONG HYDRAULIC ACTUATOR

The Armstrong Hydraulic Actuator enables you to install first-class hydraulic circuits in the easiest and most economical way in the world.

You can select a combination of the various types of Armstrong Actuator units to suit your individual requirements. Efficient assembly requires only elementary engineering knowledge, simple instructions are provided and stock embodiment items supplied.

An Armstrong Actuator does away with the need for heavy or complicated linkages and gives none of the troubles that tend to crop up with links, levers or cams. Once installed and charged, it will function for as long as the machine or structure in which it is embodied—smoothly and efficiently. This bold new conception of hydraulic control has behind it the vast experience gained by the Armstrong Patents Company Limited of Beverley. They alone, because of their unique position in the field of hydraulic engineering, are able to offer Actuators of this quality at the price.

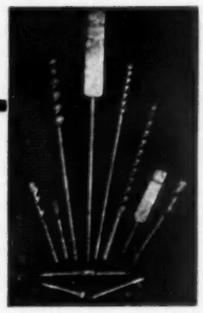
Armstrong "Off-the-Shelf" Actuators and pump units manually or power operated—put so many possibilities "within your reach" that early investigation is advised. Ask for leaflet—Apl. 51/1

ARMSTRONG PATENTS CO. LTD.
EASTGATE, BEVERLEY, YORKS. Tel. Beverley 82212
And at
Melbourne, Australia; Montreal and Toronto, Canada.

Enter No. 901 on reply card

HIGH SPEED—

PRECISION FORGINGS



275/300 blows per minute. Average size of work 1¼" bar. Adjustable stroke and guides. Rubber cushioned overhead motion. Loose Anvil Block. Separate motor stand available. A typical example of the type of work accomplished on this machine (illustrated right). For High Speed Precision Forging—the Model '100' POWER HAMMER.

SAMUEL JELLYMAN LTD
CANNOCK FOUNDRY & ENGINEERING WORKS
CANNOCK · STAFFS
TELEPHONE — TELEGRAMS: CANNOCK 2188

Enter No. 911 on reply card

MARLCo

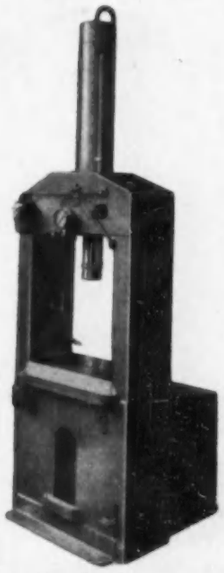
HYDRAULIC PRESSES

CAPACITY
12 20 35 50 75 and 100 tons

24 ins
STROKE AND DAYLIGHT

ALL MODELS PROVIDE
3 SPEEDS AND TONNAGES

from
MAXIMUM SPEED
to
MAXIMUM POWER
at the flick of a switch



W. H. MARLEY & Co Ltd
105 HIGH ROAD, NEW SOUTHGATE, LONDON, N.11
Telephone : Enterprise 5234/5578

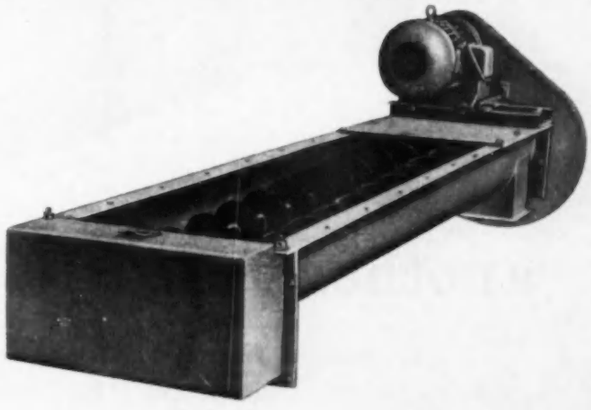
Enter No. 912 on reply card

SPECIALIST

DESIGNERS AND MANUFACTURERS OF CONVEYING AND ELEVATING EQUIPMENT

W. S. BARRON & SON LTD. GLOUCESTER

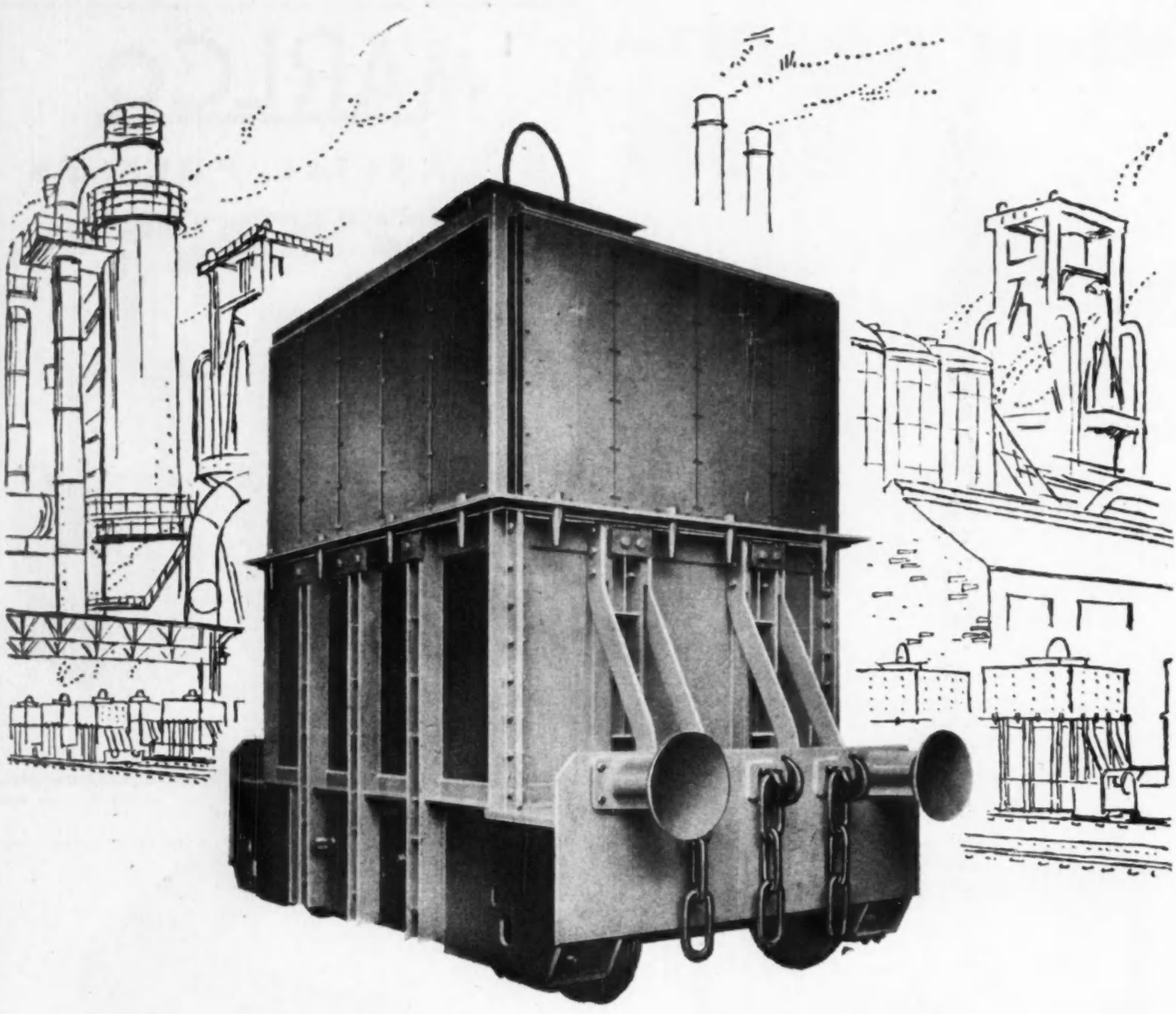
Phone: 21055/6/7 Cable: BARRON Gloucester



TWIN OR MULTIPLE WORM BIN DISCHARGER

TAPERED OR VARIABLE PITCH WORMS DRIVEN BY AN ELECTRIC MOTOR REGULATE THE FLOW OF MATERIAL FROM STORAGE BINS. SIZES TO SUIT ANY LAYOUT. ESPECIALLY USEFUL FOR EXTRACTING DIFFICULT MATERIALS.

Enter No. 913 on reply card



another THORNTON contract

This Insulated Transfer Car is one from a large contract recently supplied to Messrs. Colvilles Ltd. They are fitted with removable covers and insulated for conveying two 20 ton hot ingots. The Transfer Cars are made to suit British Railways standard gauge.

If it's a heavy engineering contract—try Thornton's first!

B. THORNTON LTD.

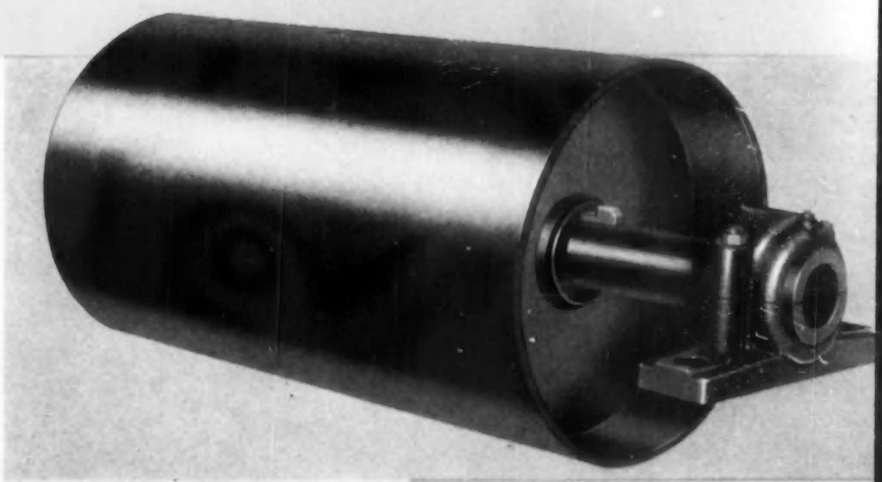
TURNBRIDGE, HUDDERSFIELD Telephone : HUDDERSFIELD 7541

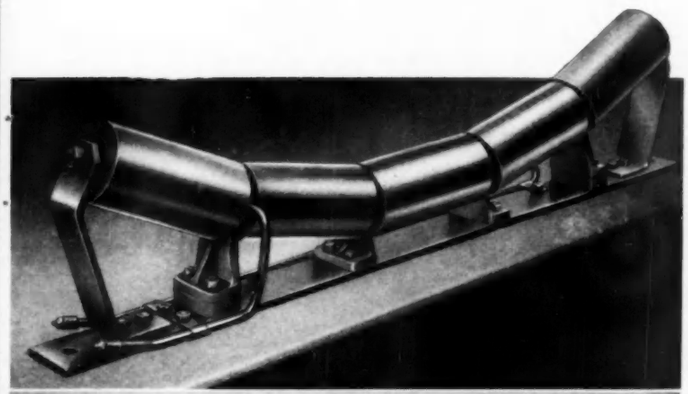
Enter No. 921 on reply card

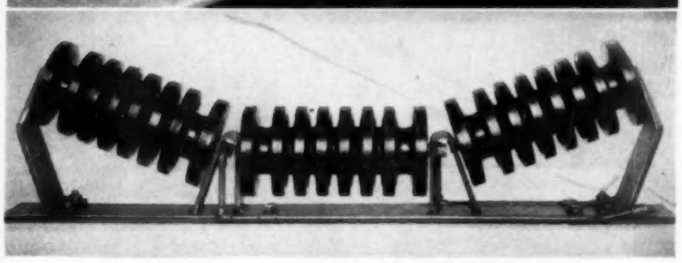
For every Belt Conveyor specify
WESTWOOD DAWES Idlers and Pulleys

Welded Steel Pulleys

Available either flat or crown face in any combination of diameter, face width and bore. Pulleys only or assembled with shafts, bearings, tension slides, etc. All pulleys fully machined on face.







Troughing Idlers

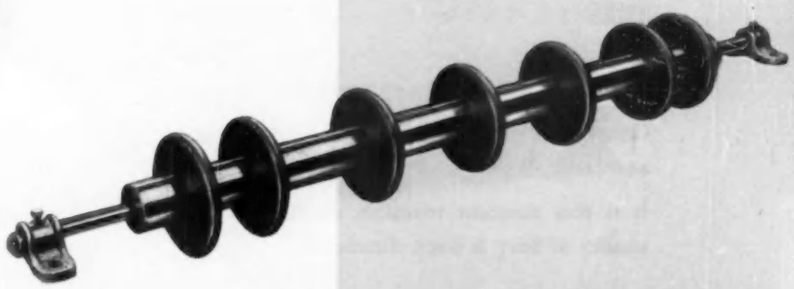
The widest possible range from which to choose.
3 roll type or 5 roll type.
Roll Diameters: 3in. 4in. 5in. or 6in.
Cast Iron or Steel tube rollers.
All available with Grease-Packed and Sealed, Self-lubricating ball bearings or with external grease fittings.

Long-Life Rubber Disc Return Idlers

These are of great advantage when used on conveyors carrying wet and sticky materials as they prevent build-up of material on the return idlers, which in turn causes uneven running and belt misalignment.
They will also greatly increase belt and idler life on conveyors handling coke—sinter—ash or abrasive ores.

Impact Resistant Idlers

100 per cent increase in belt life can be expected when fitting our Rubber Disc type " impact idlers " at all loading points.



All Idlers can be adapted to suit existing structures

WESTWOOD DAWES & COMPANY LIMITED

BOWLING GREEN ROAD,
STOURBRIDGE, WORCS.
Tel.: Stourbridge 4741

Enter No. 931 on reply card

M

How BORG & BECK quality is maintained

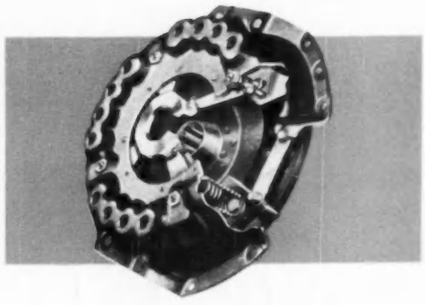
Friction clutches

The artist's impression shows one of the many testing machines used in the evolution and testing of Borg & Beck clutches.

The operator is checking torque capacity; the stability of clutch facings is also tested on this machine.

Other machines test clutch facings for coefficient of friction, wear and other characteristics.

It is this constant research which maintains the progress and quality of Borg & Beck clutches.



A catalogue showing the wide range of Borg & Beck clutches, and Rockford 'over-centre' clutches and power take-offs, will be sent on request.

The small illustration above shows the 13" Borg & Beck strap-drive clutch.

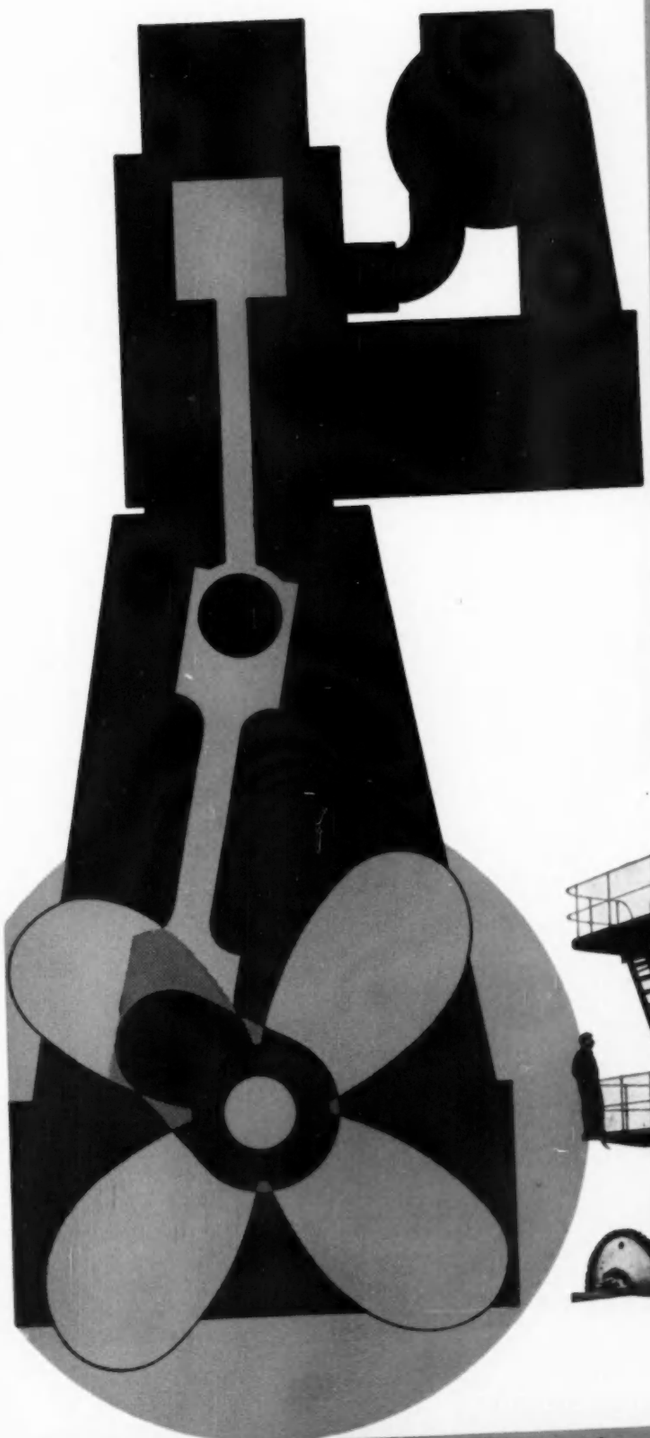
BORG & BECK

REGD. TRADE MARK

BORG & BECK COMPANY LTD. LEAMINGTON SPA, WARWICKSHIRE, ENGLAND

ONE OF THE AUTOMOTIVE PRODUCTS GROUP

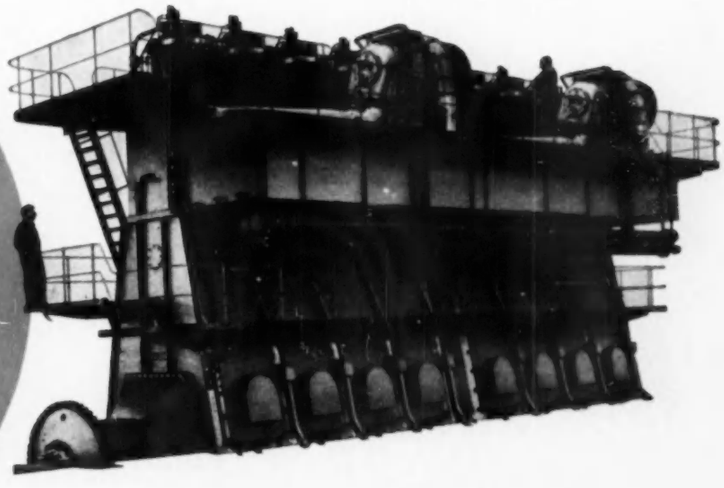
Enter No. 941 on reply card



SULZER

Marine Diesel Engines
Type RD

combine quality and simplicity



Sulzer Bros. (London) Limited
31 Bedford Square
London, W.C.1

Sulzer Brothers Limited
Winterthur, Switzerland

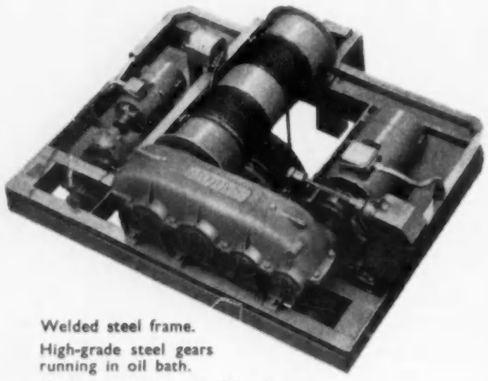
Enter No. 951 on reply card

MORRIS

STANDARD
ELECTRIC
CRANES

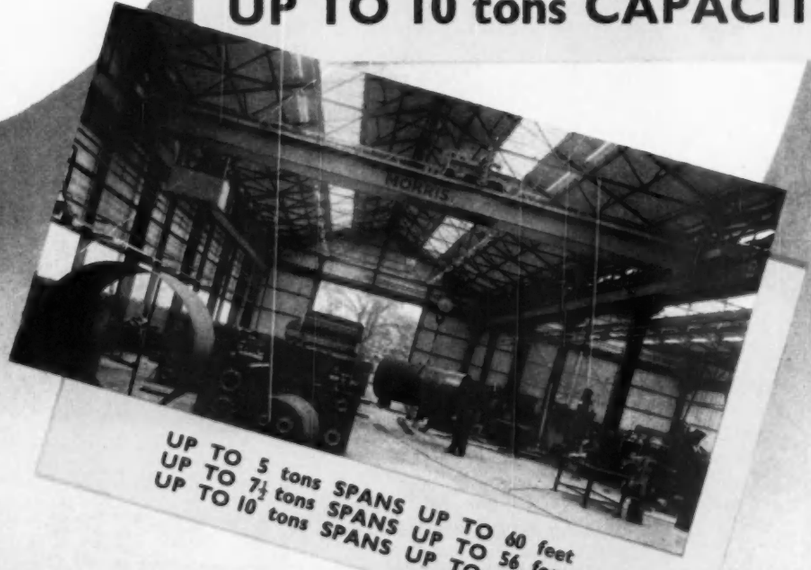
10 WEEKS DELIVERY

MORRIS
STANDARD CRANE CRAB



Welded steel frame.
High-grade steel gears running in oil bath.
High-grade precision ball-bearings.
Centralized grease-gun lubrication.
Robust electro-mechanical brake.

UP TO 10 tons CAPACITY



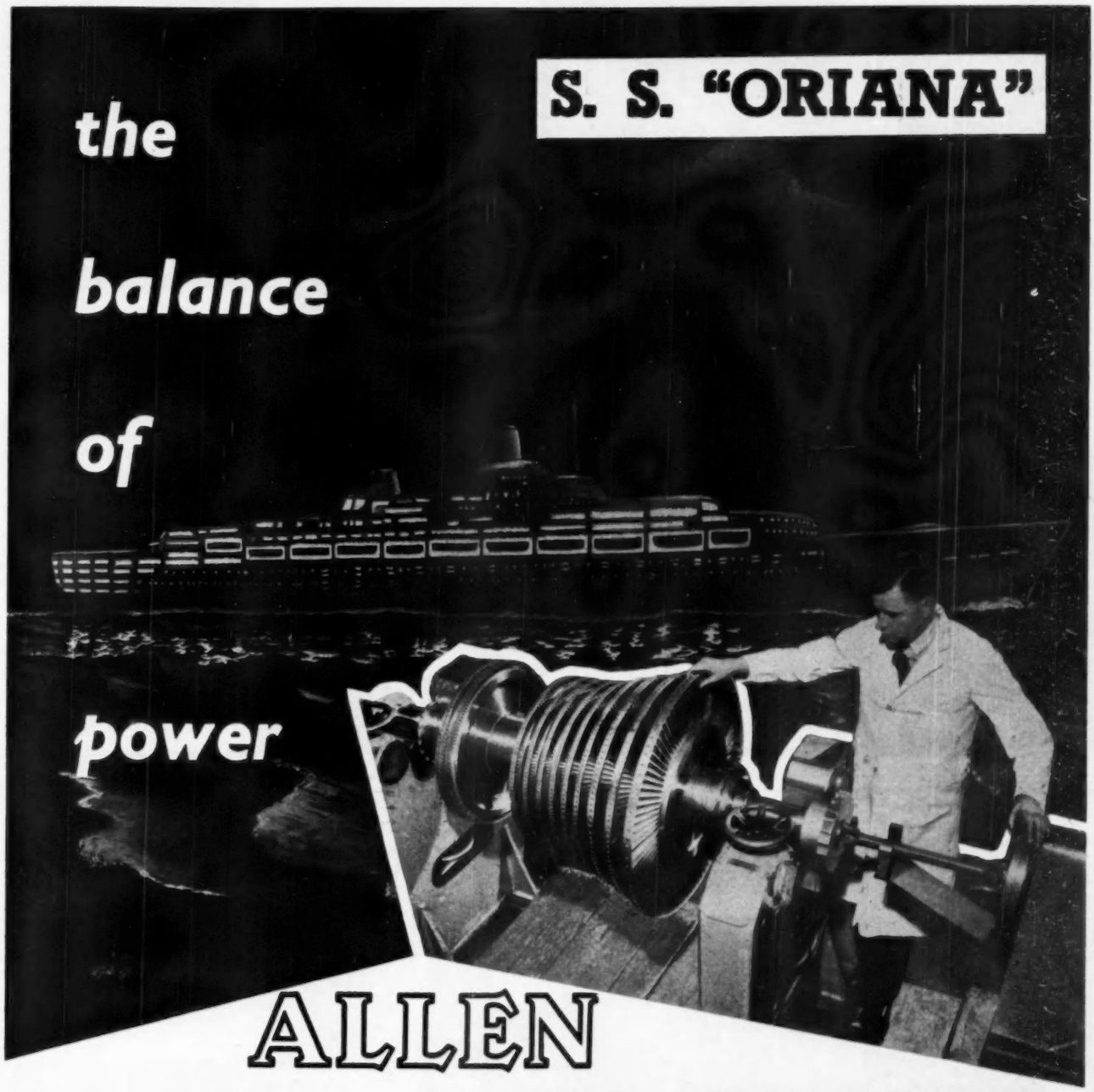
UP TO 5 tons SPANS UP TO 60 feet
UP TO 7½ tons SPANS UP TO 56 feet
UP TO 10 tons SPANS UP TO 56 feet

MANUFACTURERS
OF CRANES
UP TO
200 tons CAPACITY

HERBERT MORRIS LTD P.O. Box 7 LOUGHBOROUGH ENGLAND.

TELEPHONE: LOUGHBOROUGH 3123

Enter No. 961 on reply card



ALLEN

PASS-OUT PASS-IN TURBO-GENERATORS

provide the total electricity requirements and low-pressure steam for the P & O—ORIENT Liner, s.s. 'ORIANA,' built by Vickers-Armstrongs (Shipbuilders) Ltd., Barrow-in-Furness.

Each of the four Allen self-contained sets is capable of a normal full-load output of 1750kW at 220 volts d.c. The turbines operate with steam at a pressure of 700 p.s.i.g. at 950 degrees F., and each is designed to pass out steam at 65 p.s.i.g. in varying quantities up to 18,500 lbs. per hour when supplying steam to all the hotel and auxiliary services or, alternatively, to pass in the surplus exhaust steam from the air-conditioning turbo-compressors when they are supplying steam at the above conditions to these services. The turbine speed of 6250 r.p.m. is reduced through epicyclic gearing to a generator speed of 550 r.p.m. The Allen generators are of the totally-enclosed water-cooled type.

Other ALLEN AUXILIARY MACHINERY and EQUIPMENT installed in the s.s. " ORIANA " comprises :

Two 200kW emergency diesel generating sets.

28 motor-driven pumps, including all the main and auxiliary sea-water circulating pumps associated with the main engines, the air-conditioning plant and the refrigerating machinery.

222 electric motors, from ½ h.p. up to 550 h.p., driving many other pumps, fans, and compressors, the stabilisers and the broadside manoeuvring units, etc.

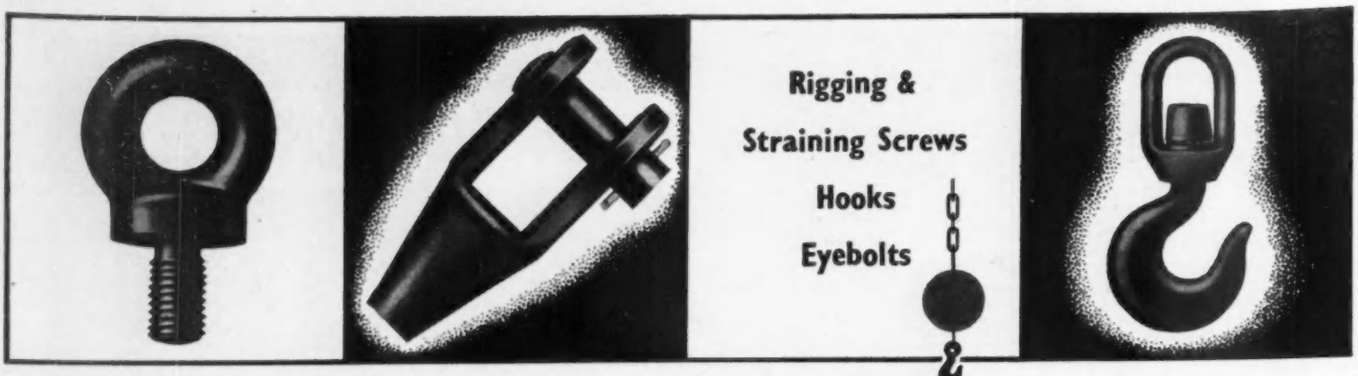
The 250 applications of Allen motors and control gear on board the s.s. " ORIANA " total over 9,000 horse-power.

W. H. ALLEN SONS & Co LTD BEDFORD ENGLAND

Telephone: Bedford 67400 *Telegrams:* Pump Bedford Telex (Telex No. 82100)

Enter No. 971 on reply card

N

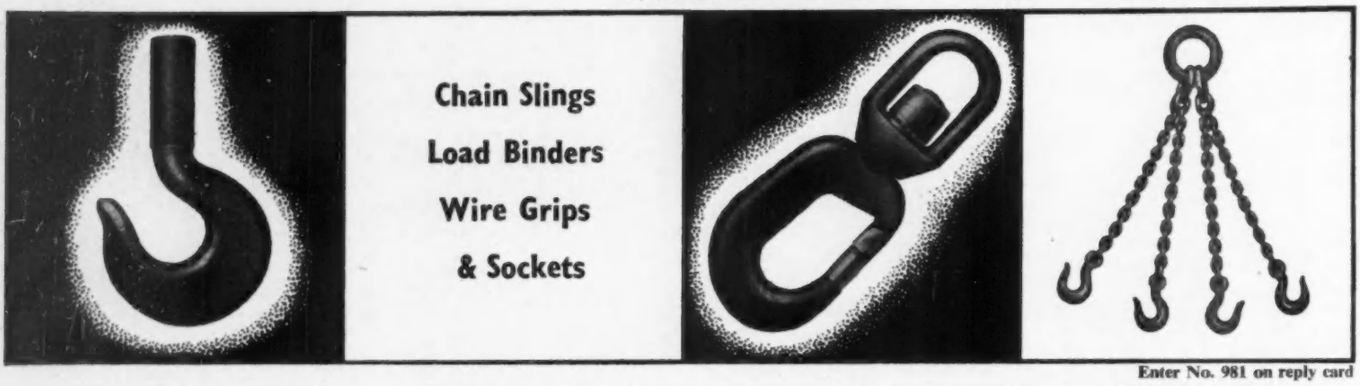


Harris-Walton

LIFTING GEAR LTD

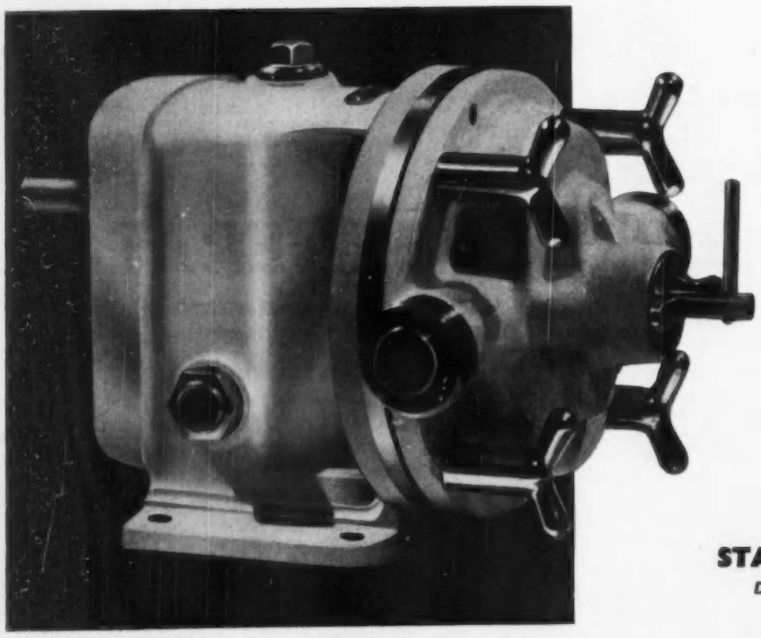
TWO WOODS LANE • QUARRY BANK • BRIERLEY HILL • STAFFS

Telephone: BRIERLEY HILL 77541-2-3 Telegrams: "LIFTWELL, BRIERLEY HILL"



Enter No. 981 on reply card

TECHNICAL SERVICE MATTERS



The selection of the right pump for the job at the right price and tough enough to accept hard work is an exercise in responsibility.

We believe that our long technical experience in dealing with pumping problems is perhaps the most important part of our business both before and after sales.

Our easy clean positive rotary pumps—particularly suitable for handling viscous or sticky liquids—are made in Stainless Steel FMB 18/8/3 quality in five sizes to handle quantities from 50–10,000 imp. g.p.h.

STAINLESS STEEL PUMPS LTD.

Dept. E, MYRTLE ROAD, EASTBOURNE, SUSSEX

Telephone: Eastbourne 6304

Concessionaires and stockists of R.E.C. Pumps in England, Scotland and Wales: C.P. Equipment Ltd., Millgreen Road, Mitcham, Surrey. Telephone: Mitcham 2081 (4 lines).

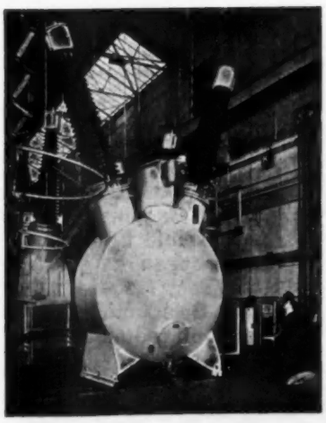
Enter No. 982 on reply card

KARIBA at 330 kV.

All the bushing porcelains for the 330 kV. circuit breakers
All the 330 kV. strain insulators for the substations
and the 330 kV. post insulators for some of the substations by

BULLERS

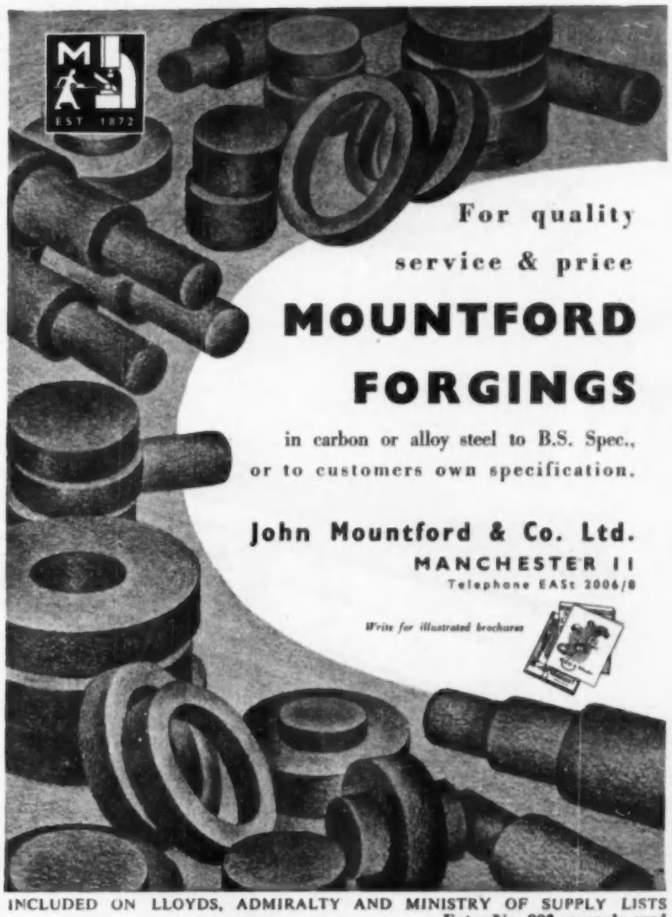
MAIN CONTRACTORS · B.T.H. Co. Ltd.
Consulting Engineers · Merz & McLellan



The illustrations show a complete 330 kV. bushing insulator and a 330 kV. circuit breaker, by courtesy of the B.T.H. Co.

BULLERS LIMITED · MILTON · STOKE-ON-TRENT · STAFFS
Telephone: Stoke-on-Trent 54321
London: 6 Laurence Pountney Hill, E.C.4. Tel.: MANsion House 9971

Enter No. 991 on reply card



INCLUDED ON LLOYDS, ADMIRALTY AND MINISTRY OF SUPPLY LISTS
Enter No. 992 on reply card

Serving Britains Industry
GRIFFIN BRAND
STEEL SHEETS
Light and Heavy Industry are served by Griffin Brand Steel Sheets—Black, Galvanised, Flat and Corrugated.
We make the widest steel sheets and have the largest general galvanising plant in Great Britain
Metal Spraying by the most up-to-date methods done in our works or 'in situ.'
Metals deposited include: Zinc, Tin, Aluminium, Copper and all its alloys, Cadmium, Monel Metal, etc.
Smith and McLean Ltd.
179 WEST GEORGE STREET
GLASGOW, C.2.
Tel.: CENtral 9442. 'Grams: "CIVILITY Glasgow."

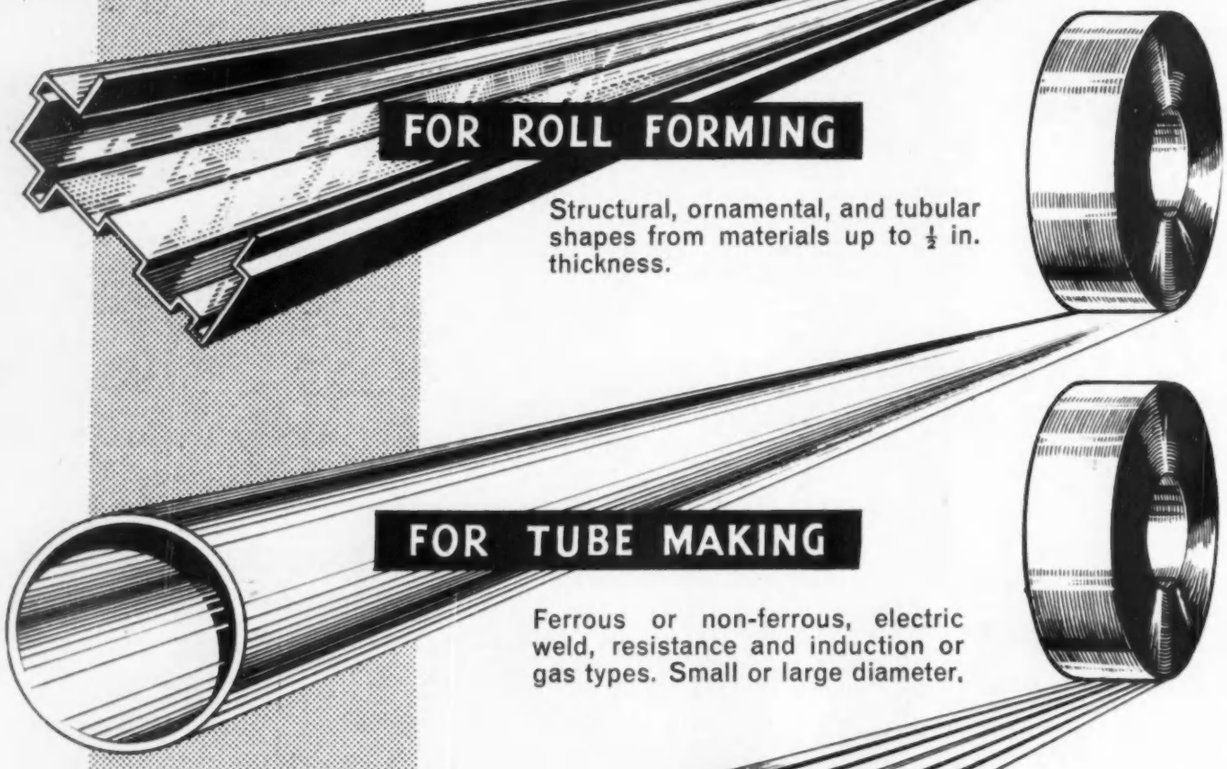
Enter No. 993 on reply card

ENGINEERING
YODER
MANUFACTURING

—the name that always comes to mind

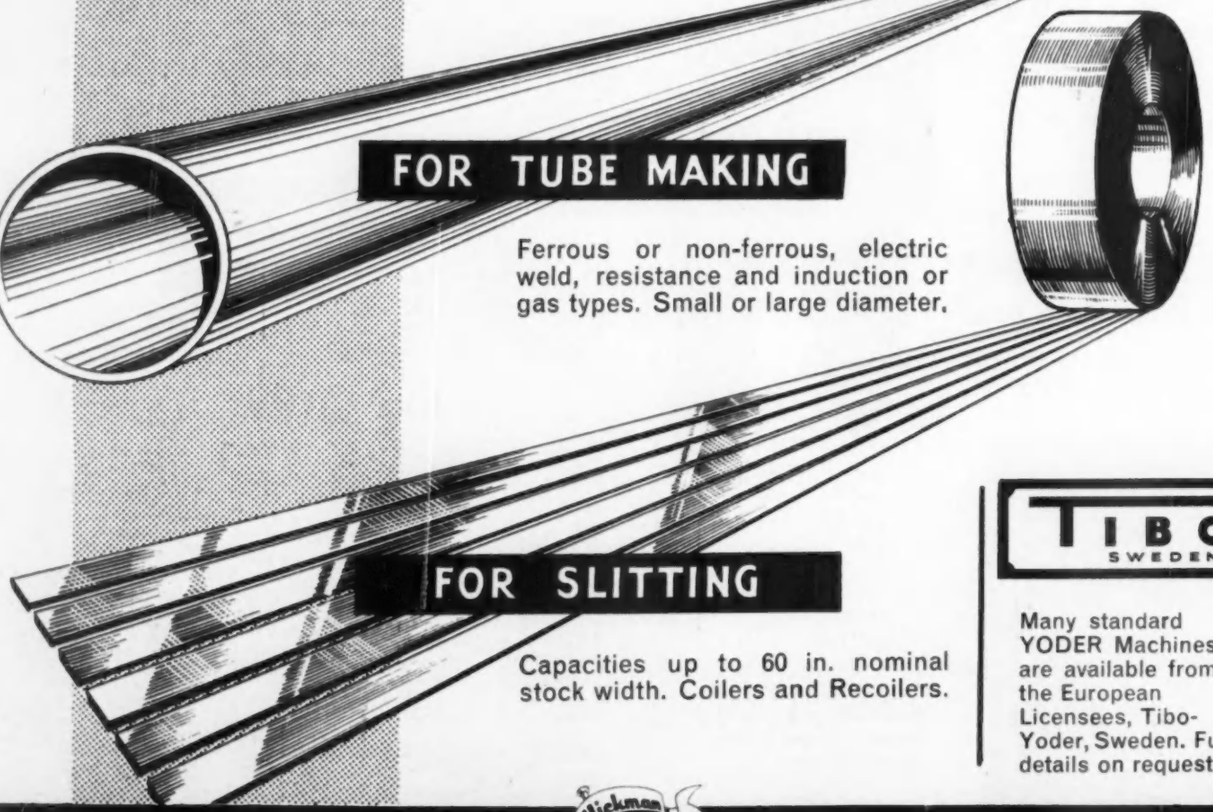
FOR ROLL FORMING

Structural, ornamental, and tubular shapes from materials up to ½ in. thickness.



FOR TUBE MAKING

Ferrous or non-ferrous, electric weld, resistance and induction or gas types. Small or large diameter.



FOR SLITTING

Capacities up to 60 in. nominal stock width. Coilers and Recoilers.

TIBO
SWEDEN

Many standard YODER Machines are available from the European Licensees, Tibo-Yoder, Sweden. Full details on request.

Wickman

WICKMAN LIMITED

FACTORED MACHINE TOOL DIVISION, FLETCHAMSTEAD HIGHWAY, COVENTRY Tel. 74321

561 F47

Enter No. 1001 on reply card

WISAFORM

plywood

FOR CONCRETE SHUTTERING

WISAFORM is Birch Plywood constructed of many veneers and, therefore, exceptionally durable and rigid.

WISAFORM is glued with pure phenolic glue. It will stand boiling and all climatic conditions.

WISAFORM special surface is permanent, completely resistant to wear, and highly fire resistant.

WISAFORM edges are sealed and impregnated with phenolic based resin.

WISAFORM with careful handling can be used up to 70 times, and its use for concrete form work means an important saving to the Building Contractor.

HRP 4-059

STRONG * DURABLE * RIGID IN USE

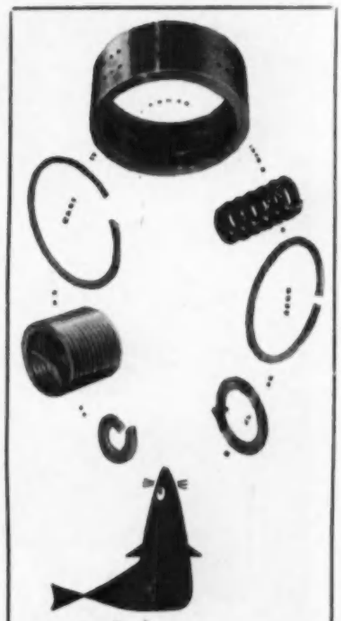
Est. 1863

C.F. ANDERSON & SON LIMITED

ISLINGTON · LONDON · N.1

Telephone: CANonbury 1212

Enter No. 1011 on reply card



precision...

Cross British made products are manufactured by an outstanding process used for the hardening and tempering of steel coils and rings. Covered by many patents, this manufacturing method has enabled components to be made from wire and with superlative accuracy. When top standards are essential you can rely on Cross precision products.

CROSS

MANUFACTURING COMPANY (1938) LTD.

BATH · SOMERSET · ENGLAND

Phone: Combe Down 2355/8
Telegrams: "CIRCLE" BATH

Enter No. 1012 on reply card

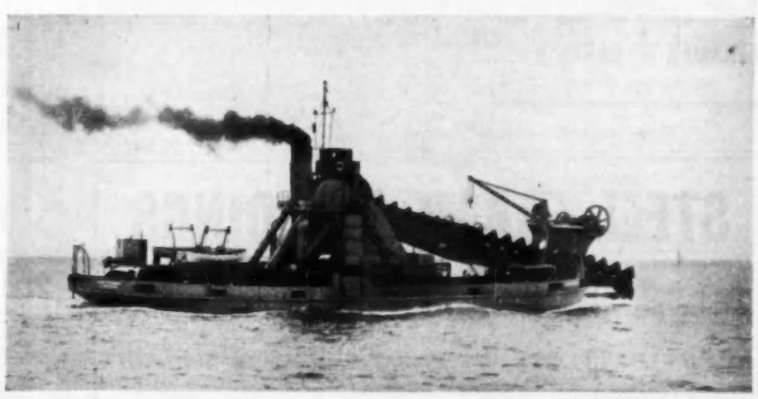
DREDGING PLANT

To the Largest Dimensions and Capabilities.

PATENT CUTTER HOPPER DREDGERS
PATENT DIPPER DREDGERS, BUCKET DREDGERS, GOLD & TIN RECOVERY DREDGERS, FLOATING CRANES.

Hopper Barges, Screw Steamers, Side and Stern Paddle Wheel Steamers, Tugs, etc.

New Buckets, Links, Pins, Gearing, etc, supplied for existing Dredgers.



Twin Screw Bow Well Bucket Dredger "Abertawe" constructed for the Great Western Railway Company. Dimensions: 160ft. x 40ft. x 14ft. Speed: 8½ knots. Buckets: 27 cub. ft. Specified Dredging Output: 900 tons per hour.

FLEMING & FERGUSON LTD.

Phone: Paisley 4121 **SHIPBUILDERS & ENGINEERS, PAISLEY, SCOTLAND.** *Tel. Add. "Phoenix Paisley."*

London Agents: Messrs. NYE & MENZIES Ltd., Capel House, 62, New Broad St., E.C.2 *Phone: London Wall 4846*

Enter No. 1013 on reply card

ON THE
STOTHERT & PITT
HYDRAULIC TILTING
DRUM CONCRETE MIXER

The hydraulic system is safeguarded by the . . .

PUROLATOR FILTER

AUTOMOTIVE PRODUCTS COMPANY LTD · LEAMINGTON SPA · WARWICKSHIRE

ONE OF THE AUTOMOTIVE PRODUCTS GROUP

Enter No. 1021 on reply card

WELDED STEEL PLATEWORK
in ⅛" to ½" thick Mild Steel

PRESSURE VESSELS
TANKS & CYLINDERS
CHIMNEYS
DRYERS
HOPPERS
CYCLONES
BEDPLATES
ANGLE & FLAT BAR RINGS

C & M. ENGINEERING CO. LTD

THAMES Rd. BARKING, ESSEX
TELEPHONE: RIPpleway 3011-2

Enter No. 1022 on reply card

PRIEST FURNACES
FOR STRESS RELIEVING

PRIEST FURNACES LTD · LONGLANDS · MIDDLESBROUGH

F127

Enter No. 1023 on reply card

STEEL FRAME BUILDINGS
OF EVERY DESCRIPTION

Factories, Sheds, Mill Buildings, Bungalows, Etc. Etc.,

SPECIALITIES: Pit Headgear, Pumping Stations, Power Stations

Bridgework and Riveted Work of all descriptions

BROWNLIE & MURRAY LTD.
POSSIL IRONWORKS, POSSIL PARK, GLASGOW
LONDON: 32 QUEEN VICTORIA ST., E.C.4

Enter No. 1024 on reply card

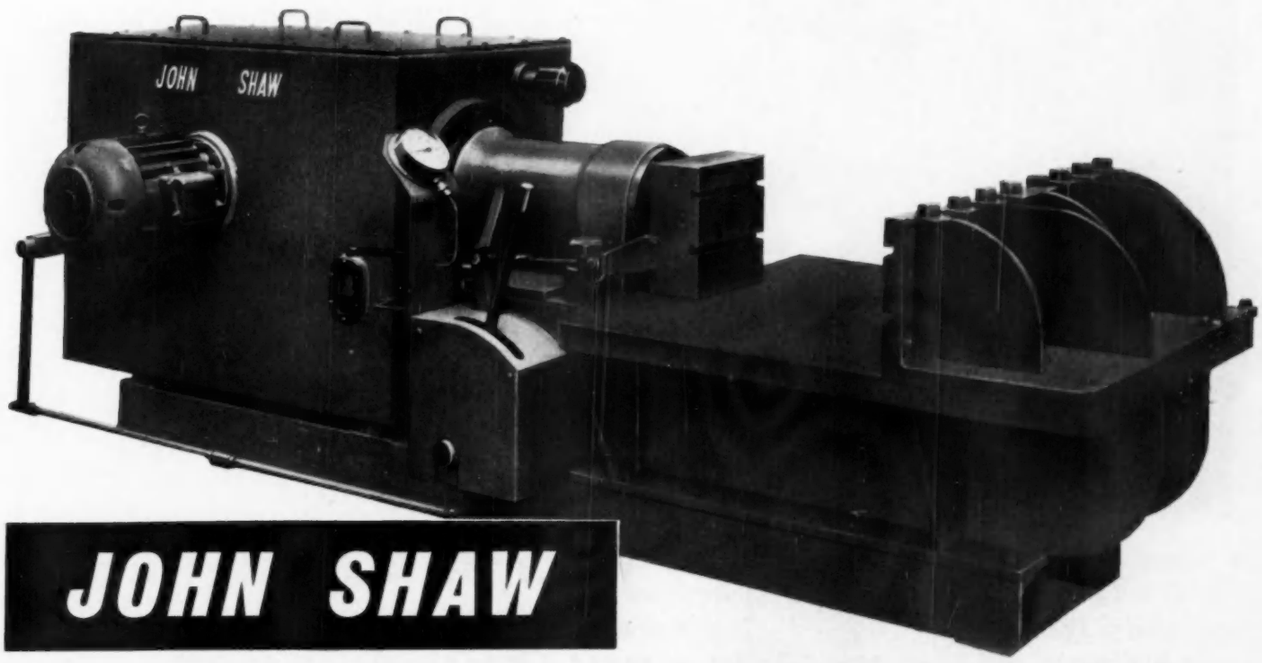
Famous for Forgings of

all descriptions in alloy and Carbon Steels
(all heat treatment facilities)

T.S FORSTER & SONS LTD
FORGEMASTERS AND ENGINEERS
COPPERAS BANK FORGE, SUNDERLAND
TEL: 2876 'GRAMS: 'FRAMES' S'LAND

Enter No. 1025 on reply card

50 TON HORIZONTAL HYDRAULIC BENDING PRESS...



JOHN SHAW

A general purpose self-contained bending press operated by a 4 h.p. electrically driven oil pump unit. The press has single lever operation with a simple and neatly arranged control stand on which is mounted pressure gauge, stop and start buttons.
Width of bed, 3′10″; working height from floor 2′1″; pressing block 13″ high; maximum working distance between crosshead and block 2′5″; travel of crosshead 15″.

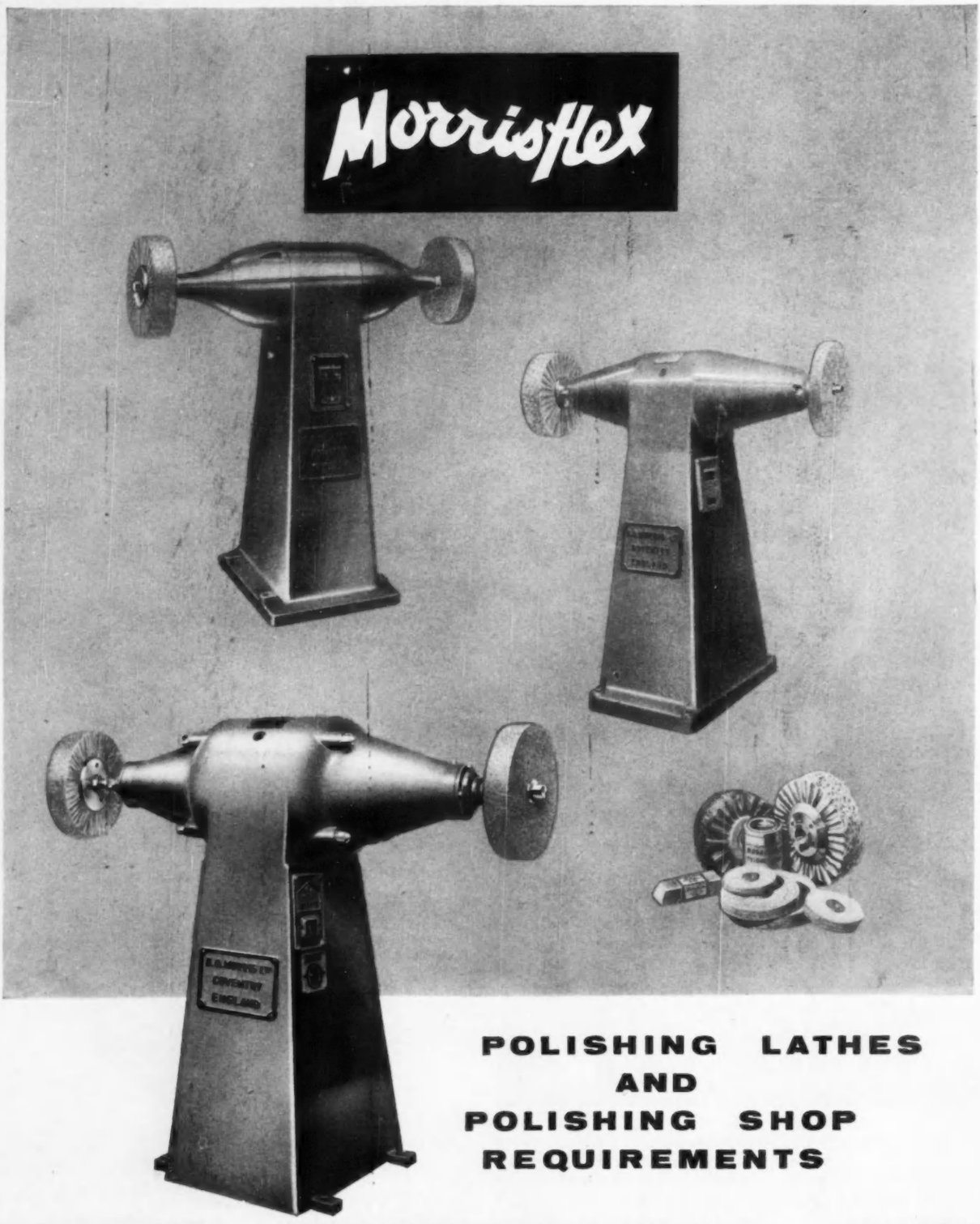
Operating Speeds:-

Quick approach .....70″ per min.
Pressing speed up to 25 tons.....18″ per min.
Pressing speed from 25 tons to 50 tons .....9″ per min.
Return speed.....120″ per min.

JOHN SHAW & SONS (SALFORD) LTD. St. STEPHEN STREET. SALFORD 3. LANCS Phone: BLAckfriars 4844

JS 24

Enter No. 1031 on reply card



POLISHING LATHES AND POLISHING SHOP REQUIREMENTS

B. O. MORRIS LTD. • MORRISFLEX WORKS, BRITON ROAD • COVENTRY

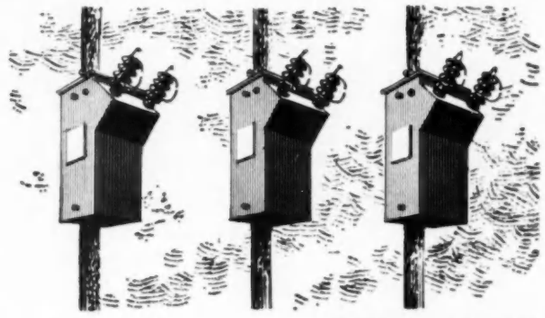
Telephone : 53333 (PBX)

Telegrams : MORISFLEX, COVENTRY

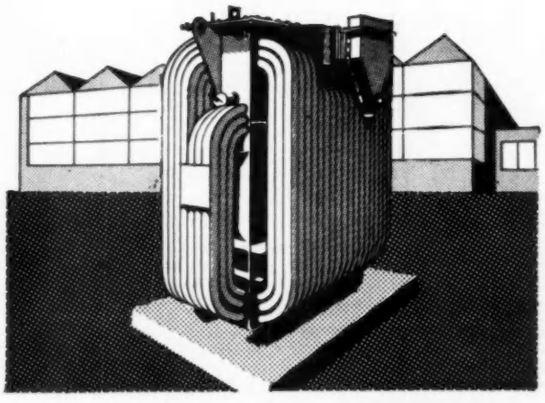
PRODUCT OF THE Morrisflex GROUP

Enter No. 1041 on reply card

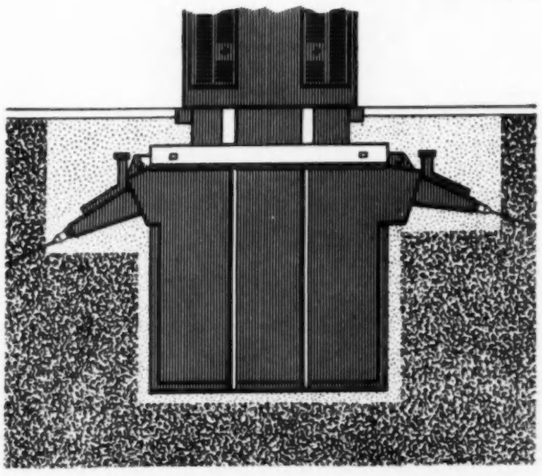
AT ALL LEVELS



POLE-MOUNTING TYPE



SUB-STATION TYPE



BURIED TYPE

Ferranti Top Quality Distribution Transformers

Ferranti Ltd. manufacture a complete range of Distribution Transformers up to 1500 kVA, 33 kV, including types to B.E.B.S. T.1 (1958). Many types can be delivered from stock and a quick delivery service is available for transformers built to customers' special requirements. Full details will be supplied on request.

FERRANTI LTD · WEST GORTON · MANCHESTER 12 Tel: EASt 1301
London Office: KERN HOUSE, 36 KINGSWAY, W.C.2. Tel: TEMple Bar 6666

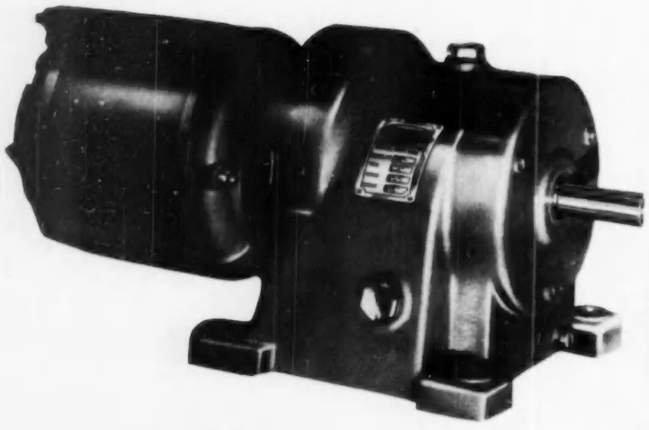
Enter No. 1051 on reply card

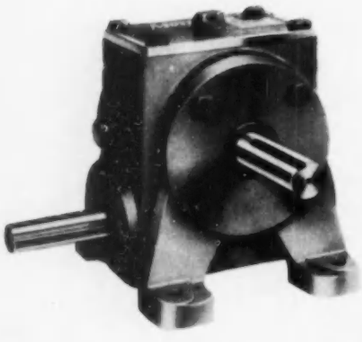
MOTOGEAR

SPUR AND WORM GEARED UNITS **FOR FRACTIONAL HORSEPOWER APPLICATIONS**

SERIES **MM**
SPUR REDUCTION MOTORISED GEAR UNITS

The scope for these units, manufactured in a range of 5 sizes, is unlimited. Their power transmission capabilities range from 2 HP max on size "A"—40 HP max on size "E" dependent on output speed required





SERIES **J**
WORM REDUCTION GEAR UNITS
UNIVERSAL MOUNTING

Series "J" Units are manufactured in 3 sizes 1¼", 1¾" and 2¼" centres with a range of 9 standard ratios for each. They are suitable for fractional horsepower applications and will mount in any desired position.

THE MOTORGEAR AND ENGINEERING CO. LTD. have specialised in the manufacture of all types of gears for over half a century and are continually extending their range of standard units to meet the requirements of industry.

MANUFACTURERS OF SPUR AND WORM GEAR REDUCTION UNITS, GEARS AND UNIVERSAL JOINTS

THE MOTOR GEAR & ENGINEERING CO. LTD.
ESSEX WORKS · CHADWELL HEATH · ESSEX · Seven Kings 3456-7745 (10 Lines)

Enter No. 1061 on reply card

The first name in Hydraulic Presses

Fawcett

for

the **BALING** of all types of natural and synthetic fibres, skins, hides, paper, scrap etc.

the **MOULDING** of plastic and rubber materials (Single and multi-platen presses with steam or electric heating).

INDUSTRIAL AND SPECIAL PURPOSES including metal powder compacting, mandrel stripping, extrusion etc.

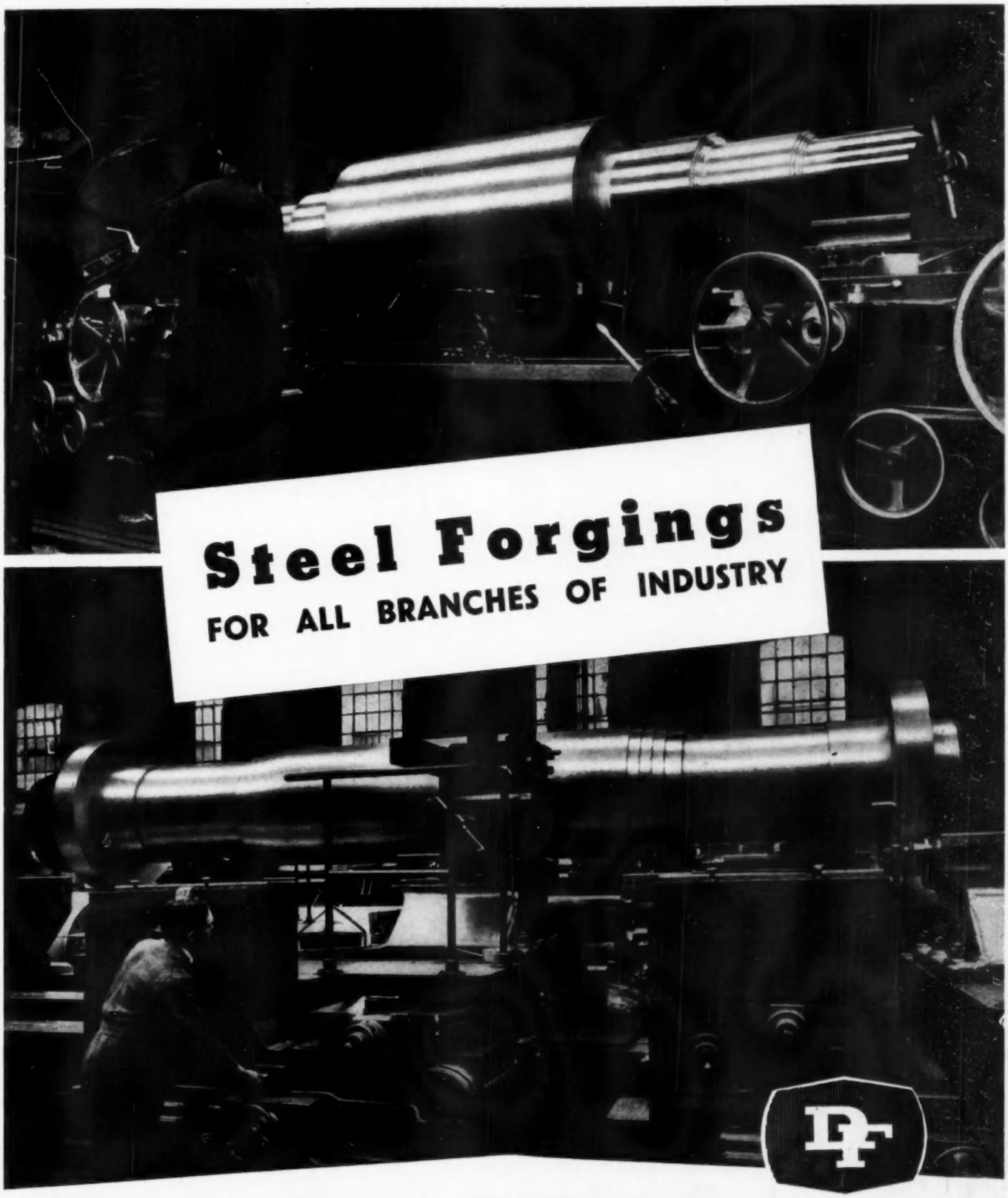
Fawcett Preston and Company Limited
BROMBOROUGH, CHESHIRE

Telephone: Rock Ferry 6181
Branch Offices: London & Birmingham

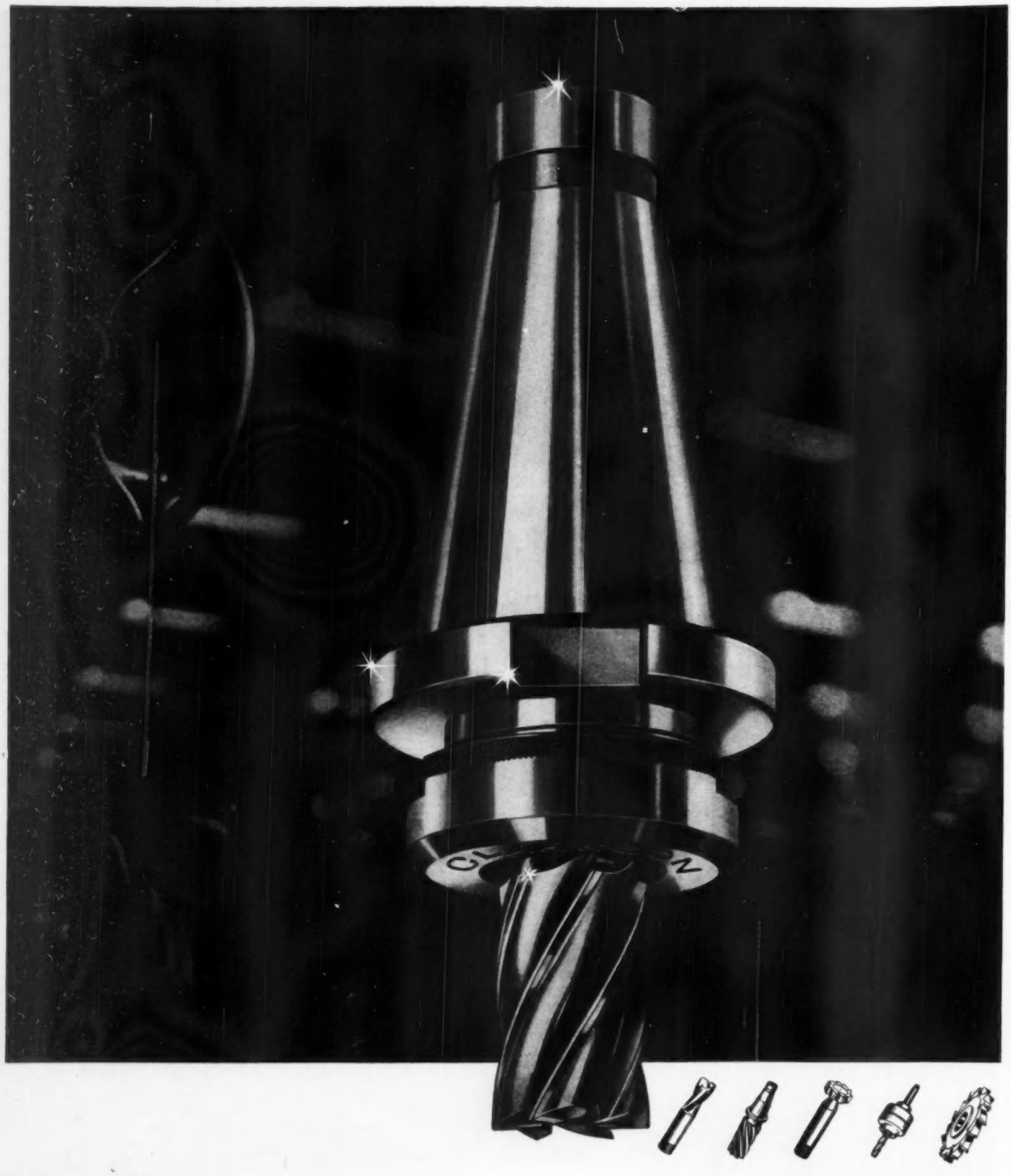
Metal Industries Group.

FP 180

Enter No. 1062 on reply card



Enter No. 1071 on reply card



Supreme Quality

Clarkson

NUNEATON, ENGLAND AND THROUGHOUT THE WORLD

Enter No. 1081 on reply card

COULD YOU USE A GOOD OASIS ?

say a mechanical one—largely automatic ? perhaps economically associated with a power station ?

WEIRWATER PLANT is producing over 10½ million gallons of fresh water a day — nearly 70% of the world's total — in

KUWAIT
ARUBA
CURAÇAO
ADEN
BAHAMAS
LOBITOS
ANDAMAN ISLANDS
GIBRALTAR
EGYPT
and in the Temperate Zone at GUERNSEY

There are many communities in the Middle East, the West Indies and other torrid climates where the natural shortage of fresh water has been overcome by the installation of Weir Sea Water Evaporation and Distillation Plant. Provided the sea is at hand and fuel is available, "Weirwater" plant will produce pure fresh water in unlimited quantities. By using low-cost steam from an electricity generating station fresh water can be produced as a by-product.

Weir

G. & J. WEIR LTD.,
CATHCART · GLASGOW S.4

Enter No. 1091 on reply card

DIRECT FROM MANUFACTURER

COMPARE THESE PRICES

ALL-STEEL STORAGE EQUIPMENT

UNI-BINS

SIZE 72" High, 36" Wide. 12 Compartments 18" x 12". 6", 9", 12", 18", 24", 30", 36" Deep, Front to Back. Size of Compartment 2" LESS, in Deep Bronze Green.

FOR ONLY COMPLETE

£4/6/1 (6")

★ 288 (3 x 3) Compartments. Finished in Deep Bronze Green. Depth, Front to Back of Unit, 6", other depths available.

£14/8/2

Also available in Grey, Red, White. Other sizes and colour prices on application.

Write for illustrated catalogue showing 36,000 variations in Steel Storage Equipment. Carriage charge 17/6d. per Unit up to 120 miles. Quantity reductions.

W·H·DIXON
ENGINEERS

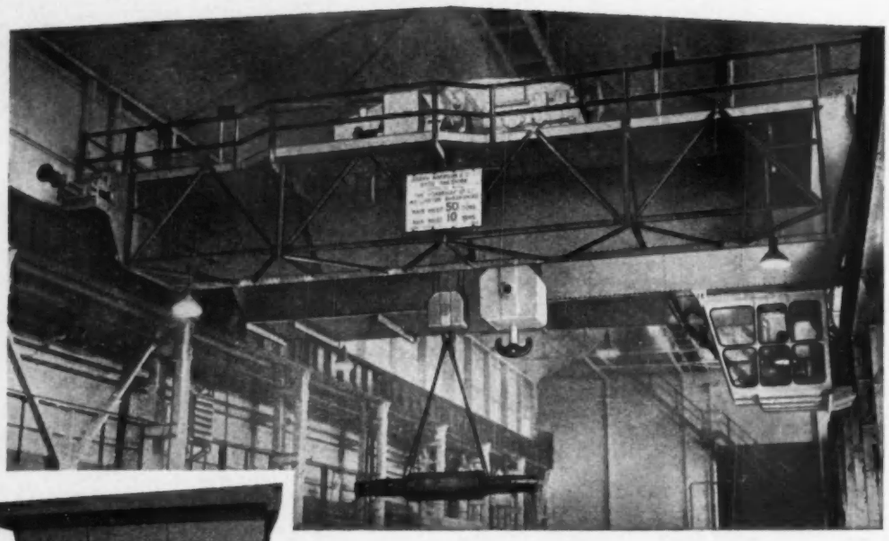
E WING . . .
BROSELEY HALL,
BROSELEY,
SHROPSHIRE.

Phone: Iron-Bridge 2332

Enter No. 1101 on reply card

JOSEPH ADAMSON

ELECTRIC OVERHEAD TRAVELLING CRANES



★ *a view of the cab showing the seat control unit.*

The Adamson 50/10 ton crane is the third of a series of new design supplied to Richard Thomas & Baldwins Limited, Ebbw Vale Section. Features of the crane include monolithic construction of the crab and the elimination of castings by mild steel fabrication of the hoist barrel and bottom block. The cab is of particular interest as it incorporates the most modern type of seat unit ensuring maximum vision and ease of control. Joseph Adamson electric overhead travelling cranes can be supplied to all specifications including cranes suited to the most exacting 24 hours-a-day process work.

JAC

JOSEPH ADAMSON & CO. LTD.
P.O. BOX 4 · HYDE · CHESHIRE

in association with

Adamson Alliance Co. Ltd., 165 Fenchurch St., London, E.C.3
Horsehay Co. Ltd., Wellington, Salop.

THE ADAMSON GROUP

Enter No. 1102 on reply card

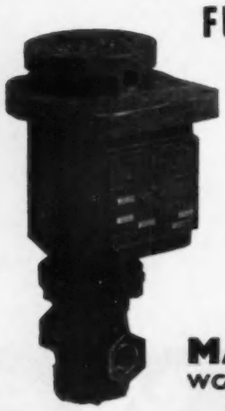
HAMMERED OR HYDRAULIC PRESSED

FORGINGS

IN STEEL BLACK OR MACHINED TO 24 TONS

THE INCE FORGE CO. LTD · WIGAN
PARKS FORGE LTD · PROPRIETORS

Enter No. 1103 on reply card



FLAMEPROOF SOLENOID OPERATED VALVES

BUXTON CERTIFIED

Pressure Ranges	0–5" W.G.
	0–5 P.S.I.
	0–15 do
	0–150 do
Bores ¼" to 4"	0–1500 do

Voltages D.C. 24v. to 550v.
A.C. 100v. to 600v.
WITH INTEGRAL RECTIFIERS

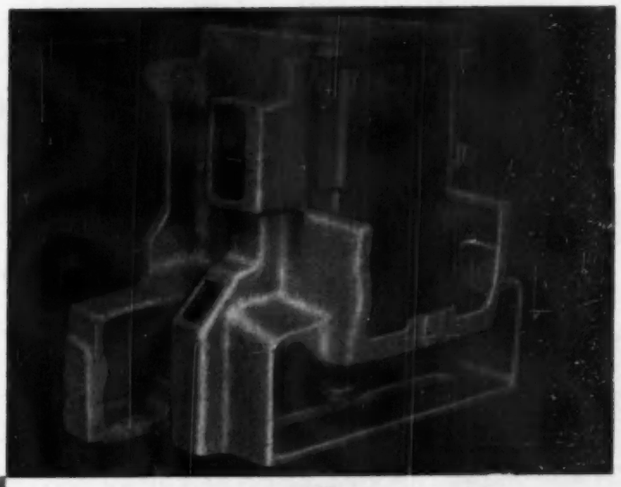
MAXSEAL VALVES LTD
WOOD ROAD, KINGSWOOD, BRISTOL
Phone: Bristol 67-3869

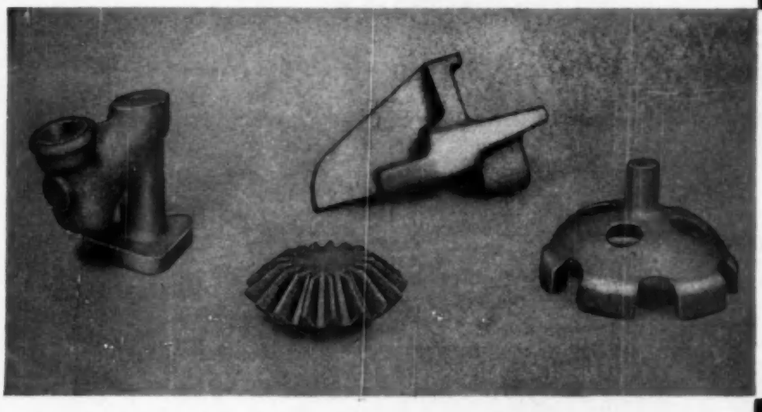
Enter No. 1104 on reply card

high quality

CASTINGS

for Industry





We can supply Castings up to 3 Tons in weight.

Our services include Design, Pattern-making, Heat Treatment, Testing and Precision Machining.

Our Technical Representative will be pleased to call and discuss your particular requirements.

ROBERT HYDE CASTINGS

NORTH STAFFORD STEEL FOUNDRY · STOKE-ON-TRENT · *Tel: 44261-2*

CLARENDON WORKS · CHESTERFIELD · *Tel: 3181-2*

LONDON OFFICE: 52, GROSVENOR GARDENS, S.W.1. *Tel: SLOANE 9972*

Enter No. 1111 on reply card

rugged robust reliable

plus all the accuracy you need

SMITHS hand tachometer

Measures *Rotary, Linear* or *Surface Speeds* in r.p.m. or f.p.m. (metric reading if necessary) to within ± ½%, even in awkward places.

AVAILABLE IN FIVE MODELS

- ★ **Self-powered, needs no battery. Always ready for immediate use.**
- ★ **Protected against sudden acceleration even above full scale.**
- ★ **Pointer lock device holds reading until convenient to view dial.**

£15.10.0 *(Complete with case and accessories) P & P 4/6 extra*

Write for full details to

SMITHS INDUSTRIAL DIVISION

The industrial business of **S. Smith & Sons (England) Ltd.,** including the marketing of industrial products under the trade marks of **Smiths** and **Kelvin Hughes**

Chronos Works, North Circular Road, London NW2 · Phone: GLA 1136

Enter No. 1121 on reply card

---

when you go gathering nuts in May, bolts in June, screws in March! . . . remember the number of Lanarkshire Bolt is Hamilton 1241-5

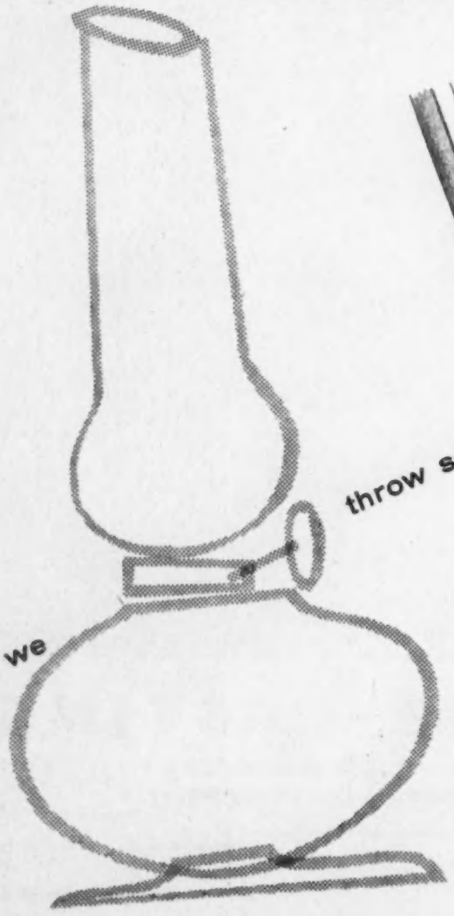
The right nut for your job doesn't grow on trees : nor does your bolt mushroom from the floor. Fact is, it's often a devil-of-a-job running the right fastening to ground. Unless of course, you know Lanarkshire. Lanarkshire Bolt run a unique system for bolt buyers. On request, each month the Company sends you the MONTHLY STOCK LIST— a publication showing materials, sizes, threads and quantities in stock. It could save you a lot of frenzied 'phone calls when stocks run low.

LANARKSHIRE BOLT LIMITED

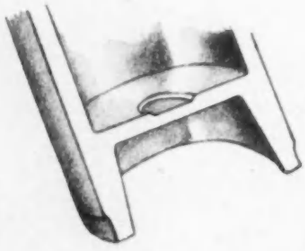
HAMILTON LANARKSHIRE

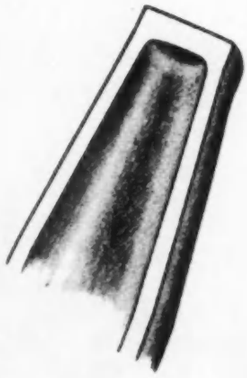
Tel: Hamilton 1241-5

Enter No. 1122 on reply card



may we throw some light on the subject of . . . hollow extrusions





. . . a light to guide the designer who seeks more efficient ways of making cylindrical products to close tolerances. In these precision hollow extrusions, the integral ends, with their wide possibilities for internal and external forms, obviate costly machining and assembly.

A leaflet explaining Reynolds Hollow Extrusions more fully will be sent on request, or our technical staff will be pleased to advise you.

REYNOLDS

REYNOLDS TUBE CO. LTD. · TYSELEY · BIRMINGHAM 11

Enter No. 1123 on reply card

Component size:
¼" dia. x 2½"
Material: ***hard steel***
Wheel: ***Sixty grit al. oxide***
Stock removal:
0.004" to 0.005"
Grinding Time:
75 seconds
Surface finish:
0.4 micro-inch C.L.A.

KG
MACHINE TOOLS

Maximum grinding length:—
9" (228 mm) or 18" (457 mm)
Work centre height:—3½" (82 mm)

The nuclear age demand for increased output, higher accuracy and superfine finish is now successfully met with the introduction of the KLGG Gauge Grinder.
The technical information given in the inset provides factual proof of this competitively priced machine's potential *employing normal production methods and without a specialist operator.*

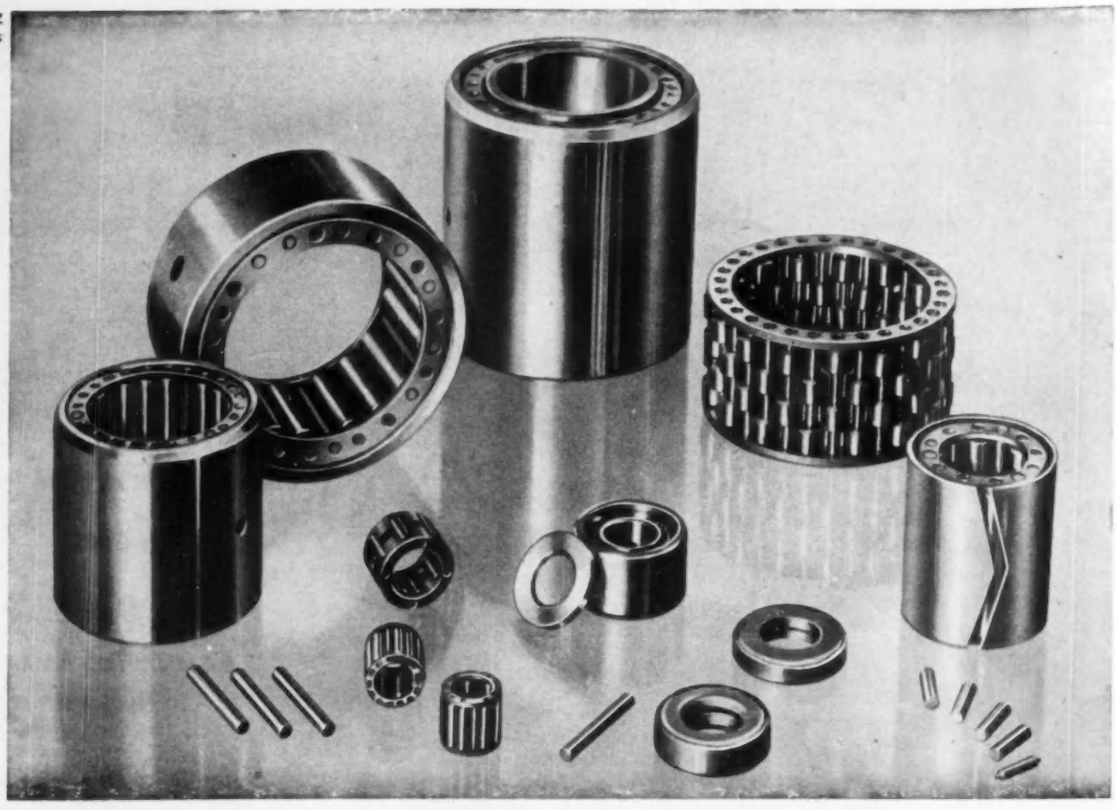
full details on request to:—

NEWALL GROUP SALES LTD

PETERBOROUGH TEL: 3227/8/9 OR KEIGHLEY TEL: 4294

Enter No. 1131 on reply card

Send today for Comprehensive Catalogue

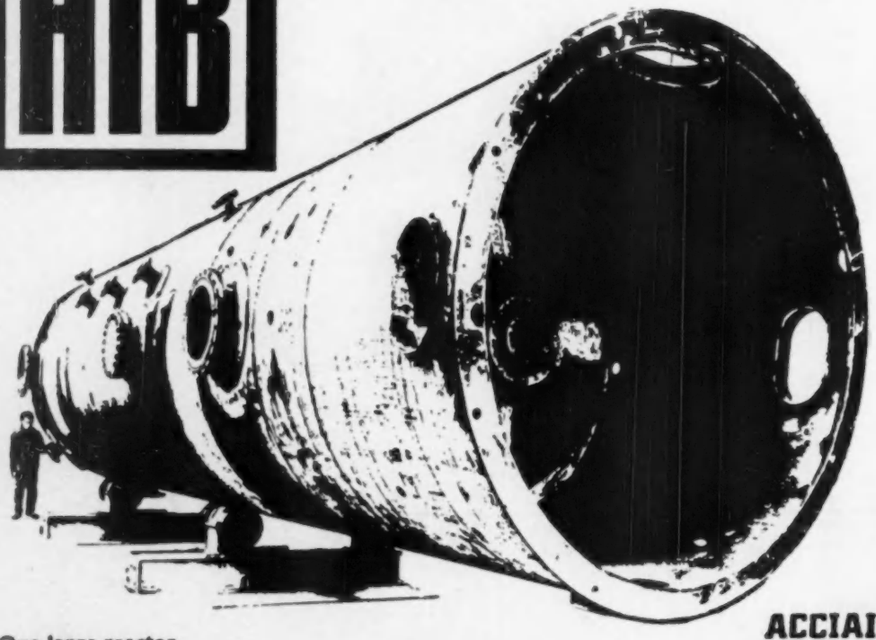


Blackwell Bearings Ltd. TEWKESBURY, GLOS., ENGLAND *Telephone:* TEWKESBURY 2018-9 *Telegrams:* WINWELL

Enter No. 1141 on reply card

ATB

answers your heavy fabrication problems



One large reactor
for synthetic rubber industry
Weight when empty 85 m. Tons.

PRESSURE VESSELS

LLOYDS CLASS I APPROVAL

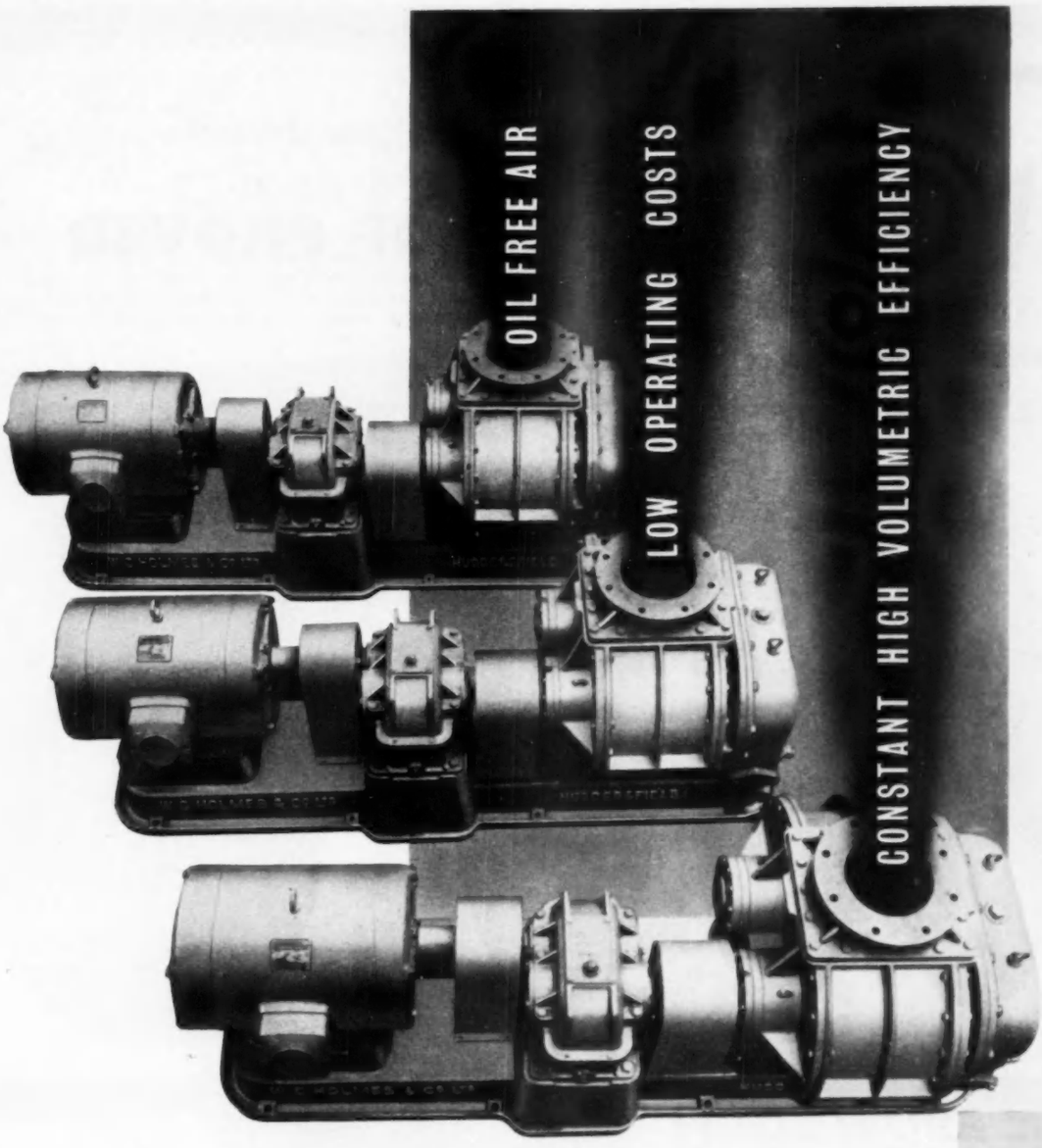
A.T.B. FACILITIES

AUTOMATIC & HELIOARC
WELDING EQUIPMENT
HEAT TREATMENT, RADIOGRAPHY
RADIOISOTOPES
DIE-PRESSED 2 : 1 ELLIPTICAL
HEADS UP TO 13" DIAMETER
& 5" THICKNESS

ACCIAIERIA E TUBIFICIO DI BRESCIA

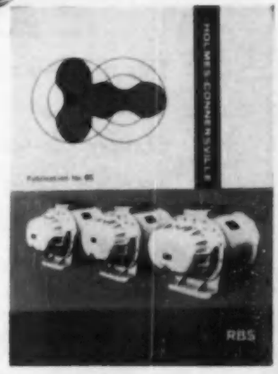
Represented in the U.K. by :
L. A. POOLE & Company - Clun House
17 Surrey Street, Strand, W.C.2.
Phone : Covent Garden 0021/2

Enter No. 1142 on reply card



HOLMES-CONNERSVILLE POSITIVE AIR BLOWERS

Holmes-Connersville Positive Air Blowers offer many outstanding and exclusive advantages which should be seriously examined whenever dependability, superior performance and operating economy are important requirements. Recent modifications have resulted in a number of operating advantages including improved performance—the maximum pressure for certain sizes has now been increased from 10 lb. to 15 lb. p.s.i.



For full details please ask for a copy of Publication No. 85/3

W. C. HOLMES & CO. LTD.

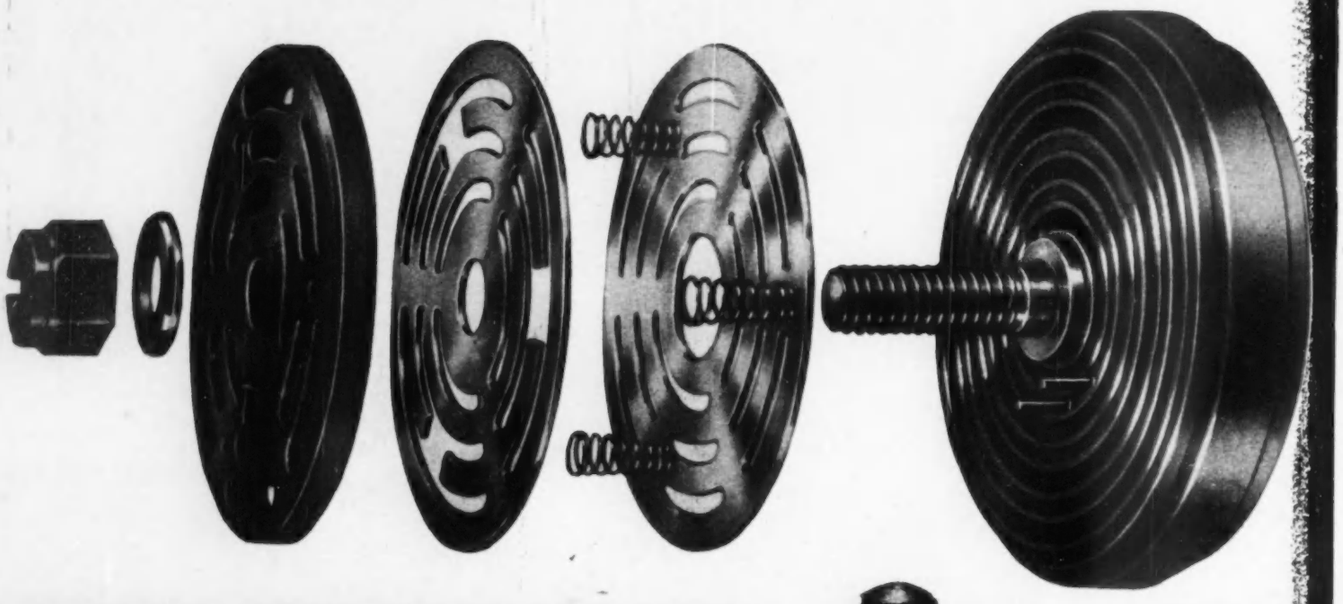
A Member of the B.H.D. Engineers' Ltd. Group of Companies.

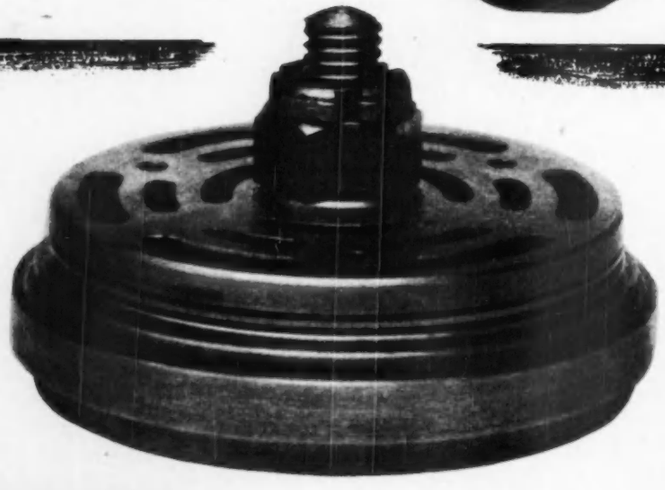
Gas Handling Division, Turnbridge, Huddersfield

Tel: Huddersfield 5280 London: Victoria 9971 Birmingham: Midland 6830

Enter No. 1151 on reply card

PRECISION VALVES OF PROVED EFFICIENCY AND DEPENDABILITY





This is an Automatic Plate or Disc Valve for an Air or Refrigerator Compressor—one example from the extensive range designed and produced by an organisation which has for seventy-five years specialised in valves and their application.

If valves are *your* problem—we suggest you get in touch with us.

THE METALLIC VALVE COMPANY LIMITED

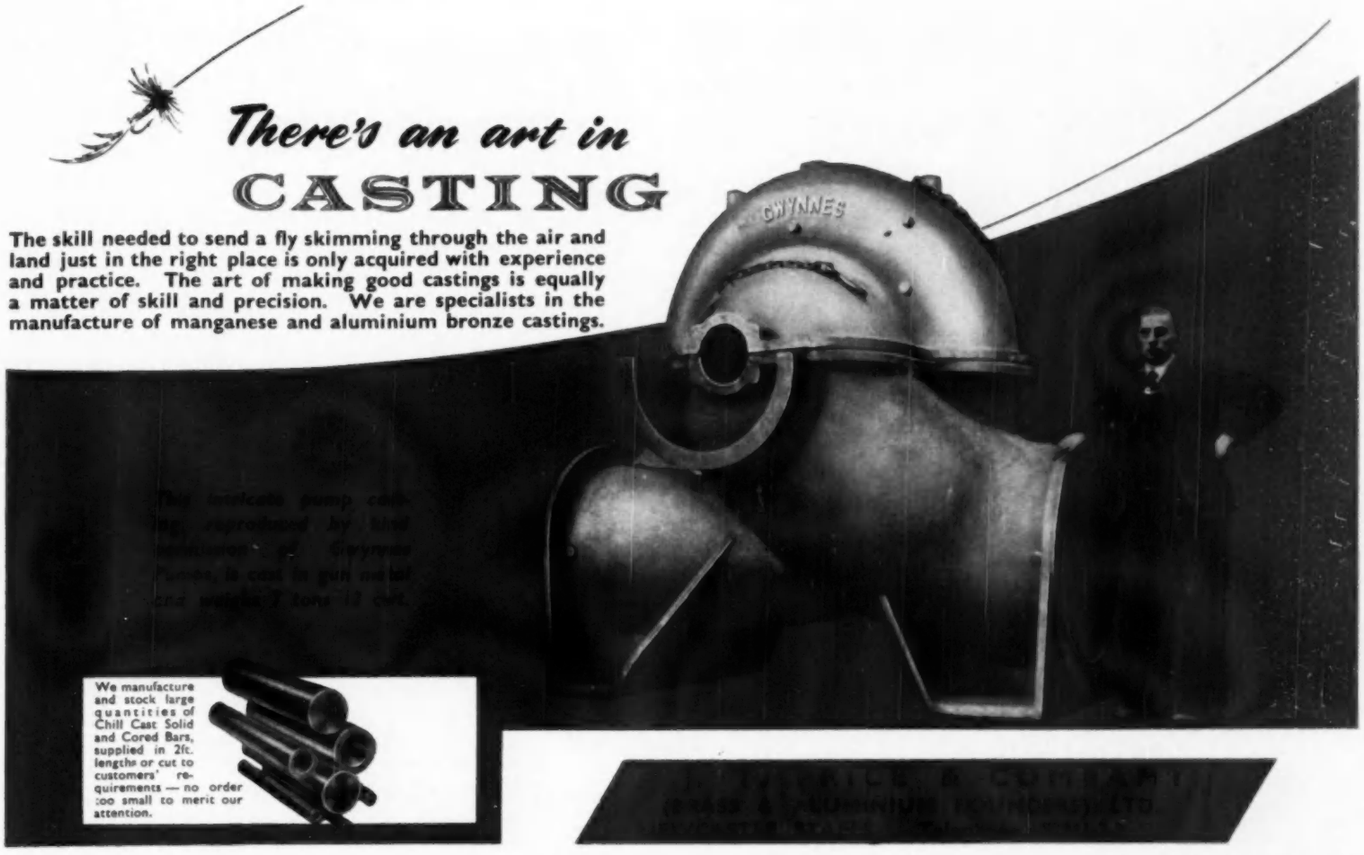
117/125 BRIDGE STREET · BIRKENHEAD · CHESHIRE · PHONE: BIRKENHEAD 8961/2

Enter No. 1161 on reply card

There's an art in

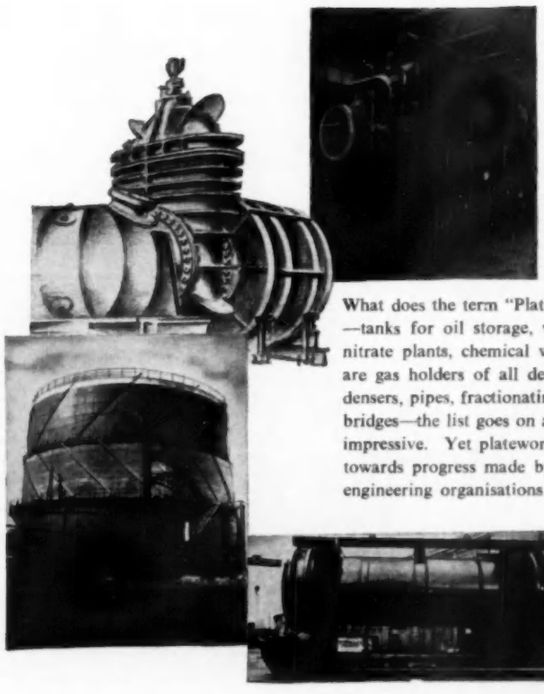
CASTING

The skill needed to send a fly skimming through the air and land just in the right place is only acquired with experience and practice. The art of making good castings is equally a matter of skill and precision. We are specialists in the manufacture of manganese and aluminium bronze castings.



We manufacture and stock large quantities of Chill Cast Solid and Cored Bars, supplied in 2ft. lengths or cut to customers' requirements — no order too small to merit our attention.

Enter No. 1171 on reply card



PLATEWORK . . .

What does the term "Platework" involve? Tanks, for instance —tanks for oil storage, water storage and softening plants, nitrate plants, chemical works, sugar refineries. Then there are gas holders of all descriptions, chimneys, bunkers, condensers, pipes, fractionating columns, structural platework for bridges—the list goes on and on and becomes more and more impressive. Yet platework is only a part of the contribution towards progress made by one of Britain's most progressive engineering organisations . . .

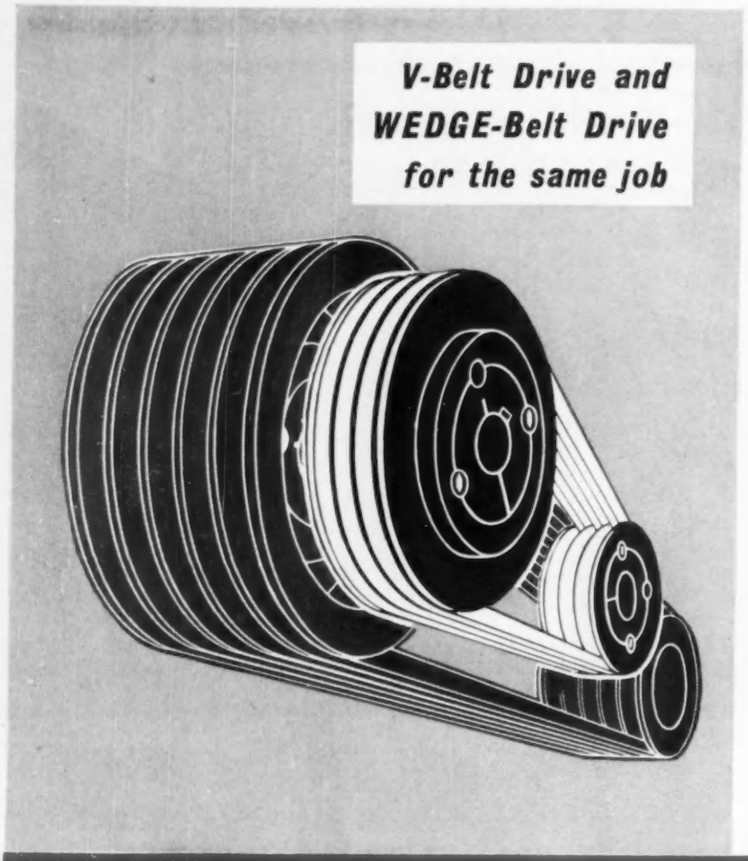
HORSELEY HI GROUP

HORSELEY BRIDGE & THOMAS PIGGOTT LTD., TIPTON, STAFFS.

CARTER HORSELEY (ENGINEERS) LTD., TIPTON, STAFFS.

HORSELEY-PIGGOTT (WATER ENGINEERS) LTD., TIPTON, STAFFS.

Enter No. 1172 on reply card



Fenner SpacesaVer Wedge-Belt Drives are

SLIMMER, LIGHTER, SHORTER, CHEAPER

- Width and weight now reduced by a half, and cost by at least a fifth, without loss of strength or durability.
- Modern materials and a new belt section give a much greater power capacity. SpacesaVer Wedge-Belts make full use of the strength and flexibility of Terylene cords. These are bonded to a synthetic rubber which keeps them exactly where they can do most work with least stress to themselves. This rubber provides heat and oil resistance and adequate electrical conductivity at no extra charge. New pulley designs take full advantage of modern casting methods to give stronger, yet lighter pulleys. All have Taper-Lock quick and easy fixing facilities.
- Two Wedge-Belt sections, $\frac{3}{8}$" (Alpha) and $\frac{5}{8}$" (Beta) cover all normal drives up to 200 horse-power. Belt lengths and pulley diameters are based on International Standardisation principles. Your complete drive design can be selected from a single line reading in the SpacesaVer catalogue 135/20. Send for it now.

THE GREATEST ADVANCE IN DRIVE DESIGN FOR 30 YEARS

HERE IS THE PROOF

DRIVE		MOTOR PULLEY DIAM.	DRIVEN PULLEY DIAM.	FACE WIDTH	V-BELTS AND WEDGE-BELTS USED	CENTRE DISTANCE	DRIVE LIST PRICE	DRIVE WEIGHT LB.
5 H.P.	V-Belt	$3\frac{3}{4}$	$6\frac{3}{8}$	$3\frac{1}{4}$	5—A29	7·5	£6 · 8 · 7	16·7
	Wedge-Belt	3·15	5·60	$1\frac{1}{2}$	3 Alpha 280	7·1	£5 · 3 · 8	10·6
	SAVING	**16%**	**12%**	**54%**	—	**5%**	**19%**	**36%**
25 H.P.	V-Belt	$6\frac{1}{2}$	$12\frac{1}{2}$	$5\frac{7}{32}$	6—B65	18·7	£17 · 0 · 7	66·8
	Wedge-Belt	5·3	10·6	$2\frac{23}{32}$	6 Alpha 560	15·3	£11 · 11 · 6	36·2
	SAVING	**18%**	**15%**	**48%**	—	**18%**	**32%**	**45%**

SpacesaVer **WEDGE-BELT DRIVES**

MADE ONLY BY

Fenner

J. H. FENNER & CO. LTD. HULL

Catalogue 135/20 details drives up to 200 h.p. Send for it NOW!

NAME AND POSITION .....

.....

FIRM'S ADDRESS .....

.....

.....

THE LARGEST MAKERS OF V-BELT DRIVES IN THE COMMONWEALTH

Enter No. 1181 on reply card

ALL WELDED FABRICATION

PROVIDES A STRONGER MORE ACCURATE SPUR WHEEL AT LOWER COST

RIM
High Tensile Steel
pressed to shape

CENTRE
Mild Steel
Fabrication

all welded by ½ in. penetration process.
Two halves bolted together.

This method of construction supersedes the conventional casting for spur wheels—patterns are not required, and the total elimination of distortion means no rejects. The cost is lower, delivery is faster.

The rings are immensely strong and more accurate ; machining done by customer is simpler, life is longer: can be stress-relieved if required.

SIZES FROM 5 FT. DIAMETER UPWARDS
TO ALL REQUIREMENTS

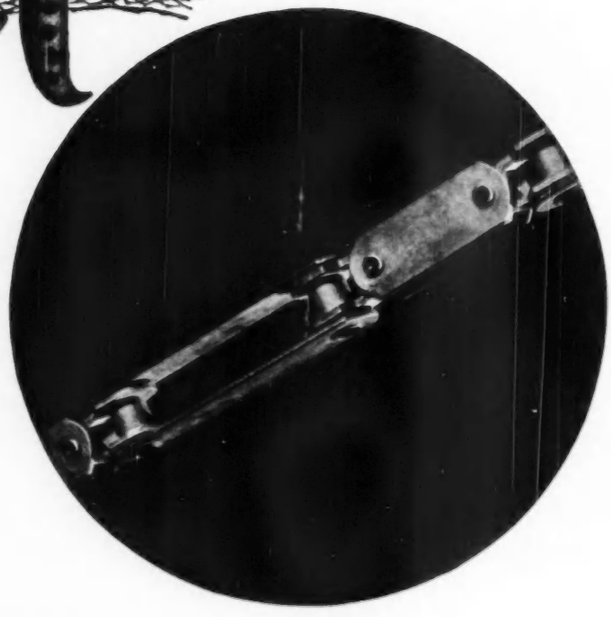
for Machine Tools, Cranes, Mechanical Handling Equipment, etc.

Extensively used by Butters Bros. in heavy cranes.

The STEEL CONSTRUCTION COY. LTD

WHITEGATES ENGINEERING WORKS,
MOTHERWELL - SCOTLAND
AN ASSOCIATED COMPANY OF BUTTERS BROS. & CO. LTD.

Enter No. 1191 on reply card



I go anywhere

Up and over obstacles . . . round corners . . . gliding smoothly and easily whatever the terrain. Just as a snake—sinuous, strong and most flexible of creatures—can travel anywhere, so can Renold conveyor chains. Fitted with biplanar attachments, a Renold conveyor chain can move in all planes and deliver your products how you want them, when you want them and where you want them.

Write for Catalogue Ref. 120/19 giving full details of

RENOLD CONVEYOR CHAINS

WITH ATTACHMENTS FOR ALL DUTIES

RENOLD

RENOLD CHAINS LIMITED · MANCHESTER

Enter No. 1201 on reply car

Over 4,000 good reasons for choosing MDX mill motors

SOME OF THE MANY FAMOUS USERS OF MDX MOTORS:

HOME

Bairds & Scottish Steel Ltd.
Briton Ferry Steel Co. Ltd.
Brown Bayley Steels Ltd.
Colvilles Ltd.
Darlington Forge Ltd.
Dorman Long (Steel) Ltd.
English Steel Corporation Ltd.
Firth-Vickers Stainless Steels Ltd.
Ford Motor Company Ltd.
Guest Keen Iron & Steel Co. Ltd.
Lancashire Steel Manufacturing Co.
Llanelly Steel Co. Ltd.
The Park Gate Iron & Steel Co. Ltd.
The Patent Shaft Steel Works Ltd.
Richard Thomas & Baldwins Ltd.
Round Oak Steel Works Ltd.
Samuel Fox & Co. Ltd.
Shepcote Lane Rolling Mills Ltd.
The Staveley Iron & Chemical Co. Ltd.
The Steel Company of Wales Ltd.
Steel Peech & Tozer
Stewarts & Lloyds Ltd.
South Durham Steel & Iron Co. Ltd.
Taylor Bros. & Co. Ltd.
The Templeborough Rolling Mills Ltd.
Thomas Firth & John Brown Ltd.
Whitehead Iron & Steel Co. Ltd.
William Beardmore & Co. Ltd.
Workington Iron & Steel Co.

OVERSEAS

Algoma Steel Corporation Ltd. (Canada)
Anglo American Corporation of South Africa Ltd.
Australian Iron & Steel Ltd.
Breedband N.V. (Holland)
Broken Hill Pty. Co. Ltd. (Australia)
Danish Steel
Indian Iron & Steel Ltd.
Turkish Iron & Steel Ltd.
Rhodesian Iron & Steel Co. (PVT) Ltd.
Tata Iron & Steel Co. Ltd. (India)

Over 4,000 MDX-type mill motors have gone into service during the last eight years in leading iron- and steel-producing works in Britain and many other parts of the world. They have established a good reputation for efficient and continuous duty. Remarkable reliability and strength, together with low inertia of rotating parts, make MDX motors ideal for driving a wide range of steelworks equipment. They have been specifically designed to withstand arduous service and are unaffected by heavy overloads. Available totally enclosed, up to 200 h.p., self-ventilated, up to 250 h.p.

Please write for further details to INDUSTRIAL MACHINES DEPT, TRAFFORD PARK, MANCHESTER 17

AEI

Associated Electrical Industries Limited

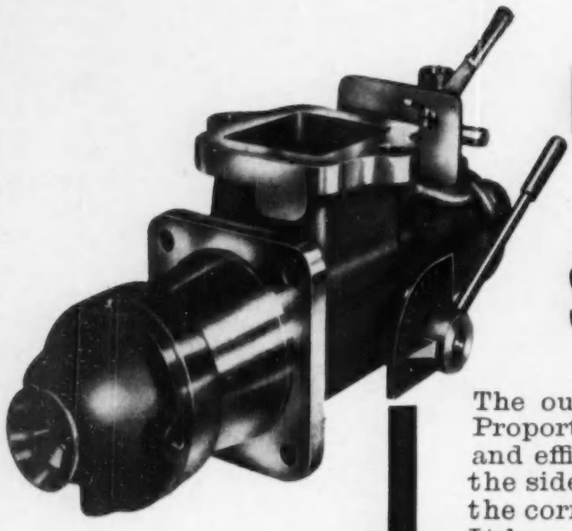
Motor and Control Gear Division

RUGBY & MANCHESTER

COMBINING THE MOTOR AND CONTROL GEAR INTERESTS OF BTH AND M-V

A5568

Enter No. 1211 on reply card



Here is one Oil Burner that brings efficiency SIMPLY to hand

The Burner shown has a maximum output of 12 gallons per hour and requires atomising air at 20" (51 cm) w.g. to 30" (76 cm) w.g. with oil at not less than 5 lbs per sq. in. (0.35 kgs per sq. cm) or equivalent head.

The outcome of 80 years' experience the Wallsend Self-Proportioning Low Air Pressure Oil Burner brings new ease and efficiency of control to oil burning. The single lever at the side automatically proportions oil and air quantities in the correct ratio and whatever the type of fuel.
It has, too, a turn down range of approximately 5 : 1 which can be achieved with a stable flame, efficient combustion and a high CO_2 content. Made with the well known Wallsend features of robustness, long service with little maintenance, and flexibility this outstanding burner leads the way, as well, to automatic or remote control of all single and multi-burner installations . . .

THE WALLSEND SELF-PROPORTIONING LOW AIR PRESSURE BURNER

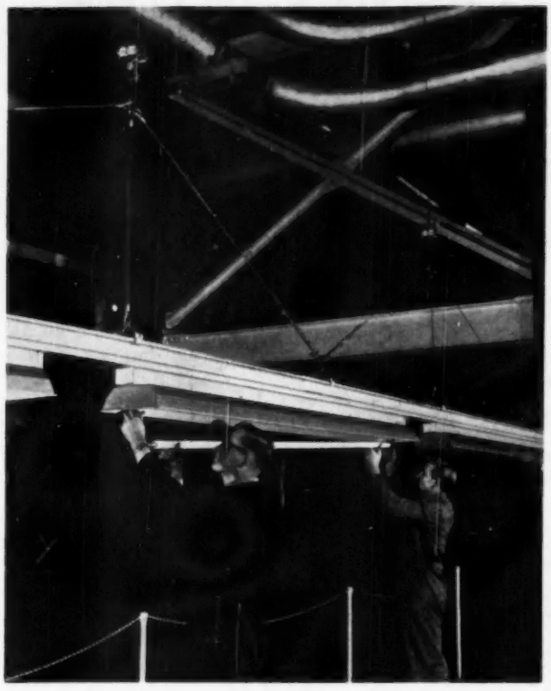
For more efficient OIL BURNING consult

THE WALLSEND SLIPWAY & ENGINEERING COMPANY LIMITED

WALLSEND-ON-TYNE

In association with **HUBBARD COMBUSTION LIMITED** Kingston on Thames

WSE 35



Safety in cleaning and servicing lighting fittings is ensured by the use of L.E.F. Raising and Lowering Gear in Vauxhall Motors' boiler house.

SERVICE IN SAFETY

"... by temporarily lowering the apparatus concerned to ground level"

says T. W. McCullough, O.B.E., H.M. Chief Inspector of Factories, Ministry of Labour, referring specifically to electric light fittings ('Factory Safety by Design', Industrial Equipment Progress, 1960).

L.E.F. Raising and Lowering Gear, for both internal and external light fittings, enables servicing to be carried out easily and quickly at floor level. It is completely concealed, entirely safe, and forms an integral part of the lighting system. L.E.F. units are easily adapted to meet any particular lighting problems.

"*The planning of safety measures can never begin too soon and the drawing board is the place at which it should start.*"

Call in L.E.F. at the planning stage, so that the simplest and most economical equipment can be built in.

L.E.F

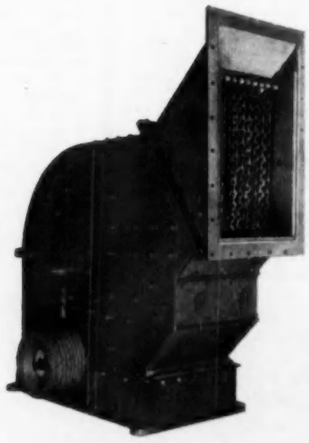
RAISING AND LOWERING GEAR

LONDON ELECTRIC FIRM LTD., Brighton Road, South Croydon, Surrey.

Phone: Uplands 4871

Enter No. 1231 on reply card

IMPACT BREAKING gives a good cubical product



Many industrial materials are best reduced in an impact breaker, such as the B.J-D Rock Buster. Breaking by impact, as opposed to crushing, gives a cubical product well suited to industrial requirements. In the Rock Buster, material is subject to impact in various ways, the chief being the action of impeller bars mounted on the rotor. There is wide control of product size.

BJD

ROCK BUSTER

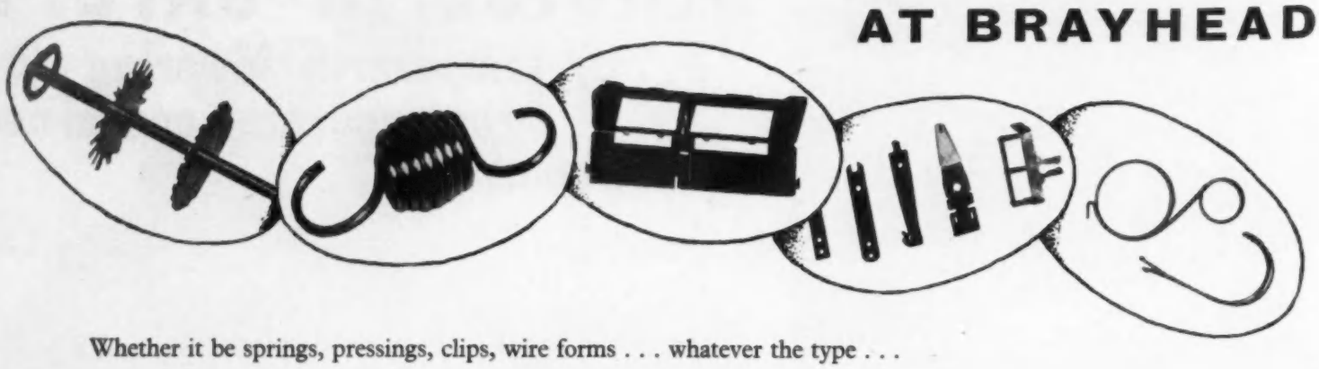
IMPACT BREAKERS

BRITISH JEFFREY-DIAMOND LIMITED, CRUSHER AND INDUSTRIAL DIVISION, THORNES, WAKEFIELD

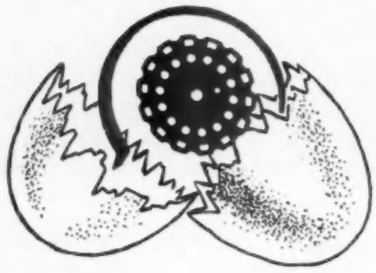
WF 5179

Enter No. 1232 on reply card

THE BEST IDEAS ARE HATCHED AT BRAYHEAD



Whether it be springs, pressings, clips, wire forms . . . whatever the type . . . of one thing you can be absolutely certain, the best high speed production ideas are hatched at Brayhead. Call in Brayhead on your next job. See the team of Brayhead Specialists. The result will be the ideal answer to the problem — made to exacting standards at a realistic price, made to precise specifications and delivered on time. A good idea? Most certainly! As we said — "the best ideas are hatched at Brayhead".



BRAYHEAD (ASCOT) LTD

KARATEPI WORKS • KENNEL RIDE • ASCOT • BERKS • *Tel: Winkfield Row 427/8 or Ascot 1907/8/9 Grams: Brayhead, Ascot*

Enter No. 1241 on reply card

LOADING LORRIES THE *FAST WAY...

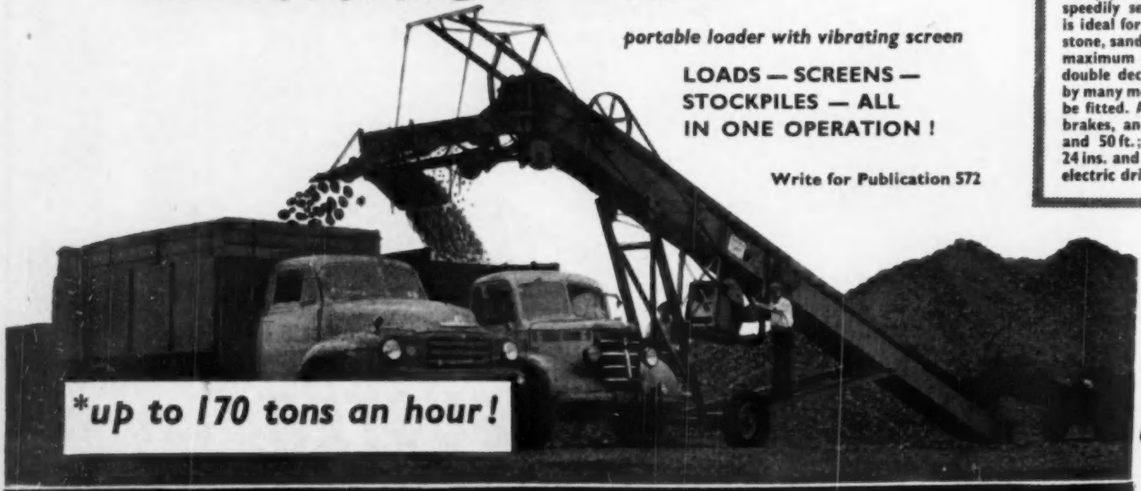
WITH A **PARKER** *'Loadascreen'*

portable loader with vibrating screen

LOADS — SCREENS — STOCKPILES — ALL IN ONE OPERATION!

Write for Publication 572

Shown here loading industrial coke, the Parker Loadascreen is a big cost-saver when it comes to conveying bulk materials where simple screening or scalping-off is required. Saves time, saves labour, saves double-handling. Handling capacity up to 170 Tons per hour according to material handled (100 Tons an hour on coal). Easily portable on pneumatic tyres, speedily set up, the "Loadascreen" is ideal for coal, coke, quarry waste, stone, sand and gravel. Screens with maximum efficiency with single or double deck screen and can be fed by many methods. Water sprays can be fitted. Available with or without brakes, and boom lengths of 40 ft. and 50 ft.; belt widths of 18 ins., 24 ins. and 30 ins.; petrol, diesel or electric drive.



*up to 170 tons an hour!

ALSO . . .
PARKER PORTABLE BELT LOADER

Easily moved by one man. Boom lengths 20' or 30'; Belt 16" or 20". Discharge heights 8'3" to 12'3". Write for full details.

FREDERICK **PARKER** LIMITED

VIADUCT WORKS, LEICESTER

PHONES LEICESTER 62531 (10 LINES)

LONDON STAFFORD HOUSE, NORFOLK STREET, W.C.2

Enter No. 1242 on reply card

CLASSIFIED ADVERTISEMENTS

PUBLIC APPOINTMENTS · SITUATIONS VACANT · TENDERS · EDUCATIONAL · BUSINESSES and PREMISES · BUSINESS OPPORTUNITIES PATENTS · MISCELLANEOUS · AGENCIES · DIRECTORS · PARTNERSHIPS

Lineage Rate. 4/6 per line of approximately 6 words. Minimum 18/-. **Inch Rate.** 54/- per single column inch and pro rata. 12 lines to 1 inch.

There are reduced rates (i.e., not on a pro rata basis) for advertisements of ¼-page (12 column inches) and upwards, e.g., ¼-page £29 10s. ½-page £54 Full page £100.

FOR SALE · MACHINERY, etc., WANTED · AUCTION SALES · SITUATIONS WANTED · SUB-CONTRACTING · DESIGN SERVICES · FOR HIRE

Lineage Rate. 4/- per line of approximately 6 words. Minimum 16/-. **Inch Rate.** 48/- per single column inch and pro rata. 12 lines to 1 inch.

There are reduced rates (i.e., not on a pro rata basis) for advertisements of ¼-page (12 column inches) and upwards, e.g., ¼-page £25 10s. ½-page £48. Full page £90.

Run-On and Semi-Displayed Styles. Both these styles are available for single column width advertisements of any depth up to 12 inches.

Displayed and Illustrated Styles. The minimum size for a Displayed advertisement is 3 inches single column, for an illustrated advertisement it is a ¼-page (12 column inches) Thereafter the sizes for both progress in steps 3 inches deep across 1, 2, 3 or 4 columns.

Use of Box Number. 2/- which includes forwarding of replies.

Copy Dates. Tuesday for publication on Friday of the same week. If proofs are wanted, copy is required on Thursday for publication on Friday of the following week.

Advertisements for publication should be addressed to:—**Classified Advertisement Dept., "THE ENGINEER," 28 Essex Street, Strand, London, W.C.2**

Urgent advertisements may be telephoned to CENtral 6565.

PUBLIC APPOINTMENTS

UNIVERSITY OF CAPE TOWN

SENIOR LECTURER IN CIVIL ENGINEERING

Applications are invited for a SENIOR LECTURESHIP IN HYDRAULICS in the department of Civil Engineering. Experience in University teaching, research or design in hydraulics or water supply will be a recommendation.

The salary is £1760 by £60 to £2060 per annum.

Applications (with copies of testimonials) should state age, experience, qualifications and research work completed or in progress, and give the names of two referees whom the University may consult. Two copies of the application and testimonials should reach the Secretary, Association of Universities of the British Commonwealth, 36 Gordon Square, London, W.C.1 (from whom memoranda giving the general conditions of appointment and further information about the work of the department should be obtained) not later than 13th January, 1961. A third copy of the application should be sent direct by airmail to the Registrar, University of Cape Town, Private Bag, Rondebosch, Cape Town, South Africa, to reach him by the same date.

The University reserves the right to appoint a person other than one of the applicants or to make no appointment. E7258

NORTHAMPTON COLLEGE OF ADVANCED TECHNOLOGY

ST. JOHN STREET, LONDON, E.C.1.

LECTURERS OR SENIOR LECTURERS

Northampton College of Advanced Technology, St. John Street, London, E.C.1, requires LECTURERS or SENIOR LECTURERS with honours degrees and industrial or research experience for the following subjects :

MECHANICS OF FLUIDS
APPLIED THERMODYNAMICS

These vacancies arise from the continued expansion of the College in Degree, Diploma in Technology, and post-graduate studies.

Salary scales : Senior Lecturer, £1588 rising to £1801. Lecturer, £1408 rising to £1601.

Particulars and forms of application are obtainable from the Secretary. E7250

WORCESTERSHIRE EDUCATION COMMITTEE

COLLEGE OF FURTHER EDUCATION, BROMSGROVE

ENGINEERING DEPARTMENT

LECTURER

Required as soon as possible. A LECTURER to teach Workshop Technology to Ordinary National Certificate courses and Machine Tools and Metrology to Higher National Certificate and Higher National Diploma courses. Candidates should hold academic qualifications in Production Engineering and have had suitable industrial and/or teaching practice.

Salary in accordance with the Burnham Scale :— £1370 by £35 (4) and £40 to £1550 per annum.

Application forms may be obtained from the County Education Officer (TS) County Education Office, Castle Street, Worcester, on receipt of a stamped addressed foolscap envelope. (G.86) E7243

LONDON COUNTY COUNCIL

CENTRAL SCHOOL OF ARTS AND CRAFTS, SOUTHAMPTON ROW, W.C.1

LECTURER

Industrial Design Department, January, 1961— LECTURER to take charge of light engineering workshop, and to instruct students in engineering technology, prototype production and model making. Industrial and teaching experience desirable. Should be corporate members of professional engineering institution. Salary : £1370 by £35 (4) by £40 (1) to £1550.

Application forms from Secretary, quoting (FE.3/E/2903/12). E7234

PUBLIC APPOINTMENTS

MIDDLESEX COUNTY COUNCIL EDUCATION COMMITTEE

HENDON TECHNICAL COLLEGE

THE BURROUGHS, HENDON, LONDON, N.4.

SENIOR LECTURER

Applications are invited for the post of SENIOR LECTURER in the Mechanical Engineering Department of the above College.

Whilst it is necessary that applicants should be able to specialise in a mechanical engineering subject, the subject offered is of less importance than the general qualities of the applicant.

The courses in the department at present include Higher National Diploma, Higher National Certificate and Ordinary National Certificate in Mechanical Engineering, with some Aeronautical content ; higher level courses are envisaged for the near future.

A good degree in mechanical engineering is required, preferably together with Corporate Membership of the Institution of Mechanical Engineers. Previous experience in academic work is desirable but not essential.

Special consideration can be given to applicants at present in industry who wish to make lecturing a career, but who have had little or no teaching experience.

Salary will be within the range £1588 to £1801 per annum.

Application forms and further information can be obtained from the Clerk to the Governing Body, Town Hall, Hendon, London, N.W.4.

C.E. GURR, M.Sc., Ph.D., E7271 Chief Education Officer.

NOTTINGHAM AND DISTRICT TECHNICAL COLLEGE

BURTON STREET, NOTTINGHAM

Principal : D. A. R. CLARK, M.Sc.(Tech.), M.I.Mech.E.

RESEARCH ASSOCIATE IN MECHANICAL ENGINEERING

Applications are invited for the post of full-time RESEARCH ASSOCIATE IN MECHANICAL ENGINEERING. The person appointed will be expected to undertake research in one of the following fields : Vibration of Machine Tools ; Vibration in Vehicles ; Critical speeds and damping ; Model analysis in production processes ; Heat transfer, Fatigue or Metal cutting. Previous research experience is desirable but not essential. The post offers considerable scope, and encouragement will be given to obtain higher qualifications. The post is tenable for three years.

Salary : £650 by £50 to £750 per annum (under review).

Application forms and further particulars may be obtained from the Principal, to whom completed forms should be returned not later than 23rd December, 1960. E7281

CITY OF BIRMINGHAM EDUCATION COMMITTEE

BROOKLYN TECHNICAL COLLEGE

ALDRIDGE ROAD, BIRMINGHAM, 22A

Principal : C. A. THOMPSON, B.Sc., Dip.Ed.

GRADE "B" ASSISTANT

Required for 1st May, 1961, or earlier if possible, a GRADE "B" ASSISTANT to be responsible for the subject of Engineering Drawing in the Engineering Drawing in the Engineering Department. Courses include O.N.D., O.N.C., C. & G. L.I. and G.C.E. Applicants should be able to offer a subsidiary subject such as Mathematics, Engineering Science or Workshop Technology.

Salary : £700 by £27 10s. to a maximum of £1150, plus additions for appropriate qualifications and training. Increments will be paid for previous teaching and/or suitable industrial experience.

Application forms and further details may be obtained from the Principal and should be returned by 7th January, 1961.

E. L. RUSSELL, E7280 Chief Education Officer.

PUBLIC APPOINTMENTS

UNIVERSITY COLLEGE OF SWANSEA

CHAIR OF CIVIL ENGINEERING

Applications are invited for appointment to the CHAIR OF CIVIL ENGINEERING which will become vacant on March 31 next.

Particulars may be obtained from the Registrar, University College, Singleton Park, Swansea, to whom applications must be sent by January 14, 1961. E7231

UNIVERSITY OF WESTERN AUSTRALIA

SENIOR LECTURESHIP IN CIVIL ENGINEERING (STRUCTURES)

Applications are invited for appointment to the above-named position for which the salary range is £A2450 by £A100 to £A2950 per annum with superannuation similar to F.S.S.U.

It is expected that the appointee will be required to lecture in analysis, design and construction in steel, timber and reinforced concrete in all stages from elementary to advanced work and to undertake laboratory work associated therewith.

It is important that intending applicants obtain details of the procedure to be followed in applying for the post and a copy of the Conditions of Appointment before submitting their applications. This information is available from the Secretary, Association of Universities of the British Commonwealth, 36 Gordon Square, London, W.C.1.

Applications close, in Australia and London, on 31st January, 1961. E7259

CITY OF NOTTINGHAM WATER DEPARTMENT

APPOINTMENT OF

(A) SECOND ENGINEERING ASSISTANT
(B) GRADE A.P.T. V. CIVIL ENGINEERING ASSISTANT

Applications are invited for the above permanent, pensionable appointments.

Salary for post (a) will be Grade "B," viz., £1460 to £1530 to £1600 to £1670 and a modern house will be available at a rent, exclusive of rates, of £120 per annum. Candidates must have had considerable experience in the design and construction of new waterworks, including supervision of contracts.

Salary for post (b) will be Grade A.P.T. V. viz., £1310 to £1365 to £1420 to £1480.

For both appointments candidates must be Corporate Members of the Institution of Civil Engineers, and the possession of an engineering degree would be an additional advantage. In each case the commencing salary will be dependent upon qualifications and experience.

Applications, with names of two persons to whom reference may be made, to Engineer and General Manager, Water Department, Castle Boulevard, Nottingham, not later than the 15th December, 1960.

T. J. OWEN, The Guildhall, Town Clerk. Nottingham. E7269

SOUTH EASTERN GAS BOARD

DIVISIONAL INDUSTRIAL ENGINEER

KENT COUNTY DIVISION

Applications are invited for the above post from persons having practical experience in selling gas for use in industry.

Applicants must have a wide experience in the construction and installation of industrial and commercial gas equipment and a sound knowledge of industrial heat treatment processes and modern production techniques.

An appropriate qualification in engineering, chemical engineering or fuel technology is essential. The successful candidate will be responsible for the development of sales of gas in factories throughout the Division. The offices are situated in Maidstone.

Salary within Group "C" of the National Salaries Table for Senior Gas Officers (National Scale) £1525 to £1725 per annum. The post is pensionable and subject to medical examination.

Applications in writing giving details of experience and qualifications and quoting reference VAC 14/1363 should be sent to the Personnel Manager, South Eastern Gas Board, Katharine Street, Croydon, within seven days. E7265

PUBLIC APPOINTMENTS

MINISTRY OF TRANSPORT

CIVIL ENGINEERS

Ministry of Transport : CIVIL ENGINEERS. Pensionable posts for men and women at least 25 and under 35 on 1st January, 1960 (extension for regular Forces service, Overseas Civil Service, established Civil Service, established civil service, and temporary Government service as Civil Engineer). Candidates must have achieved Corporate Membership of Institution of Civil Engineers or passed examinations necessary for attaining such membership. Experience in road and bridge construction essential ; knowledge of Highways Authorities' procedure desirable. London salary : £830 to £1125 according to age, rising to £1300. Promotion prospects. Write Civil Service Commission, 17 North Audley Street, London, W.1, for application form, quoting S/64. Closing date 31st December, 1960. E7261

THANET WATER BOARD

SENIOR ENGINEERING ASSISTANT

Applications are invited for the above post on Salary Scale A.P.T. III : £960 to £1140, from persons with waterworks experience, preferably including mechanical and electrical work and suitable qualifications.

An interesting programme of work is envisaged, including the modernisation and construction of new pumping and booster stations and the development of a new source.

The appointment is subject to the provisions of the Local Government Superannuation Acts, the passing of a medical examination and is terminable by one month's notice on either side.

Housing accommodation is available to the successful applicant and 50 per cent removal expenses will be paid.

Further details and forms of application may be obtained from the Engineer and Manager, Thanet Water Board, 58, Victoria Road, Margate, to whom completed forms should be addressed, endorsed "Senior Engineering Assistant" not later than the 28th December, 1960.

Canvassing directly or indirectly will disqualify. E7278

SHEFFIELD REGIONAL HOSPITAL BOARD

AREA ENGINEER

The Board invite applications for an AREA ENGINEER who will be responsible for controlling engineering schemes in hospitals in one of three areas controlled by the Board. The conditions of the appointment are those defined by Whitley Council and include the requirements of Corporate Membership of the Institution of Mechanical Engineers. The appointment is superannuable and the commencing salary will be £1665 proceeding by five annual increments to £2035 per annum. Mileage allowance is payable. Applicants should have a wide experience in designing and engineering services for large projects and experience in lighting and power would be an advantage. Applications to be submitted to The Secretary, Sheffield Regional Hospital Board, Fulwood House, Old Fulwood Road, Sheffield, 10, from whom forms of application may be obtained. Closing date for receipt of completed application forms 12th December, 1960. E7282

EASTERN REGION OF NIGERIA

CIVIL ENGINEERS

Applications are invited for suitably qualified civil engineers to fill several vacancies in the Ministry of Works. Engineers are required who will specialise in either roads and bridges or in water supply.

Salary will depend on qualifications and experience and will be in the range, £1614 to £2166 a year.

Generous leave and allowances.

For details and conditions of appointment apply to the Recruitment Officer, Office of the Commissioner for Eastern Region of Nigeria, 9, Northumberland Avenue, London, E.C.2.

E7171

Classified Advts. continued on page 126

PUBLIC APPOINTMENTS

CITY AND COUNTY OF KINGSTON UPON HULL

CITY ENGINEER'S DEPARTMENT

SENIOR MECHANICAL AND ELECTRICAL ENGINEERING ASSISTANT

Appointment of SENIOR MECHANICAL AND ELECTRICAL ENGINEERING ASSISTANT. Salary A.P.T. V : £1310 to £1480. (Commencing salary according to experience.)

Applications are invited for the above appointment from Associate Members of the Institution of Civil Engineers, Institution of Mechanical Engineers, or Institution of Electrical Engineers.

Candidates must have had considerable experience in design and maintenance, and be capable of taking charge of a section of the department which is responsible for a continuous programme of mechanical and electrical design and installation works, including high tension sub-stations, heavy duty pumping plant, electrical generation, mechanical handling, refrigeration, b ths, wash-houses, refuse disposal plant, heating, ventilating and general engineering.

Housing accommodation will be made available for the successful married candidate not already resident within the City.

Consideration will be given to a contribution towards removal expenses.

Applications on forms to be obtained from the City Engineer, Guildhall, Kingston upon Hull, are to be returned not later than 23rd December, 1960.

Wm. MORRIS, O.B.E.,
City Engineer.

Guildhall,
Kingston upon Hull. E7274

ADMINISTRATIVE COUNTY OF LEICESTER

APPOINTMENT OF BRIDGE ENGINEER

Applications are invited from professionally qualified engineers for the above-mentioned permanent appointment.

A minimum of five years experience of bridge or other structural works, three of which should have been on design, is required.

Commencing salary within the range £1310 to £1480. A car allowance is payable.

Forms of application obtainable from R. W. Grigson, B.Sc., M.I.C.E., County Engineer and Surveyor, County Offices, Grey Friars, Leicester. Closing date 23rd December, 1960. E7225

ADMIRALTY - NAVY WORKS DEPARTMENT

ELECTRICAL AND MECHANICAL ENGINEERING DRAUGHTSMEN

Vacancies exist in Navy Works Department Drawing Offices as shown below and occur at Establishments elsewhere in United Kingdom from time to time.

The posts are non-pensionable, but there will be opportunities for transfer to the Established staff.

Applicants must be competent Draughtsmen and experienced in one or more of the following types of work :

Electrical (Vacancies at Pinner (Middx.), Portland and Devonport) :

(*a*) Preparation of specifications, drawings and schedules for electrical equipment. Precis of Firm's tenders.

(*b*) Electrical installations in domestic and industrial buildings.

(*c*) Cable installations, switchgear, &c.

(*d*) Airfield lighting.

Mechanical (Vacancies at Pinner (Middx.), Portsmouth, Portland, Liverpool, Rosyth, London).

(*a*) Preparation of specifications, drawings, schedules and precis of Firm's tenders.

(*b*) District heating, including boiler installations, heating and air conditioning of domestic and specialist buildings.

(*c*) Layouts of engineering installations and workshop machinery.

(*d*) All classes of lifting appliances, pumping installations, test plants, cooking equipment, &c.

Possession of O.N.C. or similar qualification will be an advantage. Consideration will be given to successful candidates being granted assistance to obtain technical qualifications.

Salary (Men) : National Rate—subject to slight variation dependent on location : starting from £580 (at age 21) to £870 (28 and over) : maximum of scale—£955 p.a. (National Rate).

Opportunities occur for promotion to Leading grade—salary maximum £1115 p.a. (National Rate).

Five-day week ; annual leave 18 days rising to 22 after 10 years.

Candidates, who must be British subjects, are invited to apply in writing, giving details of qualifications and experience to Director General, Navy Works, Admiralty, Chamberlain Way, Pinner, Middlesex.

E6996

TENDERS

STAFFORDSHIRE POTTERIES WATER BOARD

TITTESWORTH RESERVOIR SCHEME

CONTRACT NO. 45— 27 INCH DIAMETER MAIN

The Board invite TENDERS from experienced Civil Engineering and Public Works Contractors for the LAYING of approximately 5600 lineal yards of 27 inch NOMINAL DIAMETER STEEL BITUMEN-LINED AND SHEATHED WATER MAIN with Viking Johnson couplings from Ladderedge Reservoir near Leek, to Stockton Brook, in the County of Stafford.

The Forms of Tender, Conditions of Contract, Specification and Bills of Quantities may be obtained from the undersigned on deposit of a cheque for five guineas, which will be returned on receipt of a bona-fide Tender not subsequently withdrawn.

Two separate Tenders are required :

(1) TENDER with VARIATIONS in WAGES AND MATERIALS.

(2) TENDER on FIXED PRICE BASIS WITHOUT VARIATIONS in WAGES AND MATERIALS.

The two forms of Tender and annexed documents, completed on the alternative bases mentioned above, must be enclosed in the plain envelope provided, endorsed "Tender for 27 inch diameter main—Contract No. 45," and addressed to the Chairman, Staffordshire Potteries Water Board, c/o Engineer and Manager's Office, Albion Street, Hanley, Stoke-on-Trent, and delivered not later than 12 noon on Monday, 9th January, 1961. The sealed envelope must not bear any name or mark indicating the sender. At the same time copies of the Bill of Quantities, completely priced on each of the alternative bases mentioned above, must be delivered in one separate sealed envelope, similarly addressed, and endorsed "Priced Bills for Contract No. 45," and bearing the Tenderer's name.

Tenders which do not comply with the above requirements will not be considered. The Board do not bind themselves to accept the lowest or any Tender.

C. V. BROWN, M.I.C.E., M.I.Mech.E., M.I.W.E.,
Engineer and Manager and Clerk to the Board.

Engineer and Manager's Office,
Albion Street,
Hanley,
Stoke-on-Trent. E7255

WELSH COLLEGE OF ADVANCED TECHNOLOGY

CATHAYS PARK, CARDIFF

SUPPLY OF HIGH SPEED GEAR SHAPING MACHINE

FIXED PRICE TENDERS are invited for the SUPPLY of the following machine tool, HIGH SPEED GEAR SHAPING MACHINE.

Specification :

Capacity
Maximum pitch diameter—
external spur ... ... Approx. 10in. at 6 d.p.
Maximum pitch diameter—
external helical ... ... Approx. 7in. at 6 d.p.
Maximum pitch diameter—
internal spur or helical... Approx. 6in. at 6 d.p.
Maximum face width ... Approx. 2in.
Maximum helix angle ... 45 deg.
Range of cutting speed ... Approx. 150 to 550 strokes per minute.
Horse power of motor ... Approx. 1½.

Machine to be supplied complete with electric equipment, i.e., Starter, Wiring, and Low-Volt Lighting, Coolant Pump and Fittings, Guards, Wrenches, Change Gears, Spur Guide, 1 Helical Guide, and a Steel Tool Cabinet.

Tenders will not be considered unless enclosed in the envelope provided, endorsed Welsh College of Advanced Technology, High Speed Gear Shaping Machine, addressed to the undersigned at the City Hall, Cardiff, and sent by Registered Post so as to be received not later than Monday, 19th December, 1960.

The envelope must not bear any mark indicating the identity of the Tenderer.

The Governors do not bind themselves to accept the lowest or any Tender.

Form of Tender and further details are available on application to the Principal of the College.

ROBERT E. PRESSWOOD,
Clerk to the Governing Body.

City Hall,
Cardiff. E7218

WELSH COLLEGE OF ADVANCED TECHNOLOGY

CATHAYS PARK, CARDIFF

SUPPLY OF MACHINE TOOLS

FIXED PRICE TENDERS are invited for the SUPPLY of the following machine tools.

(a) ONE—17in. swing by 4ft. 2in. between centres, SLIDING, SURFACING and SCREW-CUTTING LATHE, with accessories.

(b) ONE—18in. stroke HYDRAULIC SHAPER.

Tenders will not be considered unless enclosed in the envelope provided, endorsed Welsh College of Advanced Technology, Lathe/Hydraulic Shaper, addressed to the undersigned at the City Hall, Cardiff, and sent by Registered Post so as to be received not later than Monday, 19th December, 1960.

The envelope must not bear any mark indicating the identity of the Tenderer.

The Governors do not bind themselves to accept the lowest or any Tender.

Form of Tender and further details are available on application to the Principal of the College.

ROBERT E. PRESSWOOD,
Clerk to the Governing Body.

City Hall,
Cardiff. E7217

TENDERS

WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY

INDUS BASIN SCHEME

MANGLA DAM PROJECT

The West Pakistan Water and Power Development Authority announce that, having in September 1959 invited by international advertisement applications for firms wishing to TENDER for the Main Civil Engineering Contract for MANGLA DAM PROJECT, they have placed the contracting organisations listed below on the List of Approved Tenderers for Contract No. 2.

The decision to proceed with this project must await the availability of the funds to be administered by the International Bank for Reconstruction and Development.

List of Approved Tenderers for Contract No. 2.

(1) A consortium comprising :
Western Contracting Corporation
Raymond International (U.K.) Construction Ltd.
Enterprises Campenon Bernard.

(2) A consortium comprising :
Peter Kiewit Sons' Co.
Oman-Farnsworth-Wright.

(3) Guy F. Atkinson Company.

(4) A consortium comprising :
Utah Construction & Mining Co.
Brown & Root, Inc.
Taylor Woodrow (Overseas) Limited
Compagnie Industrielle de Travaux
Etablissements Billiard
Societe Francaise d'Entreprises de Dragages et de Travaux Publics
Societe Generale d'Entreprises.

(5) A consortium comprising :
J. A. Jones Construction Company
Grove Shepherd-MacLean Grove, Inc.
A.B. Skanska Cementgjuteriet
Angus Robertson (Overseas) Ltd.
Sir John Jackson Ltd.

(6) A consortium comprising :
Morrison-Knudsen International Constructors, Inc.
Kaiser Engineers and Constructors, Inc.
Perini Corporation
John Laing & Son Ltd.
George Wimpey & Co. Ltd.
Bechtel Corporation.

(7) Merritt-Chapman & Scott Corporation.

(8) Group 1 consortium comprising :
Christiani & Nielsen A/S
Compagnie Francaise d'Entreprises
Conrad Zschokke Ltd.
Gammon Engineers Ltd.
Holland & Hannen and Cubitts Ltd.
Giuseppe Torno & Cie.—Soc.P.Az.
C.O.E.H.B.A., S.A.
Vinnell Company, Inc.

E7229

CITY OF LEEDS

WATERWORKS DEPARTMENT

THRUSCROSS IMPOUNDING RESERVOIR SCHEME

TENDERS are invited for the CONSTRUCTION, COMPLETION and MAINTENANCE of a CONCRETE DAM, ROADS and OTHER WORKS connected therewith, situate at Thruscross, near Harrogate, Yorkshire.

Contract documents and General Arrangement and Detail Drawings are available for collection from the undersigned upon payment of Ten Guineas deposit (cheques payable to "Leeds Corporation") returnable on receipt of bona fide Tender and return of all Contract documents.

Tenders, accompanied by a list of names of employers for whom comparable work has been carried out, enclosed in plain sealed covers addressed to the Town Clerk and endorsed "Tender for Thruscross Dam," must be delivered at the Town Clerk's Office, Room 57, Civic Hall, Leeds, 1, not later than 12 noon on Tuesday, the 31st January, 1961.

KENNETH L. FORSTER, M.I.C.E.,
General Manager and Engineer.

Waterworks Department,
Civic Hall,
Leeds, 1. E7262

INDIA SUPPLY MISSION

TENDER ENQUIRY NO. SE.286

Massachusetts Avenue N.W., Washington, 8, D.C., United States of America invites TENDERS for the following :

TENDER ENQUIRY No. SE.286

For the SUPPLY of TWO 2000/2500 g.p.m. MOBILE DIESEL PUMPING SETS—required by Nyveli Lignite Corporation Ltd., India.

Specification etc., relative to the above specification, can be obtained from the Co-ordination Branch, India Store Department, Bromyard Avenue, Acton, W.3, at a cost of 7s. 2d. per Tender, and is not refundable. Tenders are to be returned direct to India Supply Mission, 2536, Massachusetts Avenue, N.W., Washington, 8, D.C., United States of America, so as to reach them by 18th January, 1961.

Specimen copy of the above enquiry can be seen at India Store Department, Engineering Branch, Bromyard Avenue, Acton, W.3, under the following references : S.3743/60/NSC/ENG.2. E7224

INDIA STORE DEPARTMENT

The Office of the Director General, India Store Department, Government Building, Bromyard Avenue, Acton, W.3, invite tenders for the following:-

FIFTEEN Six-and eight-spindle BAR AUTOMATICS.

Specifications etc., relative to the above specification, can be obtained from the Co-ordination Branch, India Store Department, Bromyard Avenue, Acton, London W.3, at a cost of 10 shillings per Tender, and is not refundable.

Tenders are to be returned to the India Store Department, Bromyard Avenue, Acton, W.3, so as to reach them by 2 p.m. on Thursday, the 5th January, 1961.

Specimen copy of the above enquiry can be seen at Engineering Branch, of India Store Department, under the following reference: 2058/60/ENG.3/SGH. E7238

TENDERS

NEW SOUTH WALES

METROPOLITAN WATER, SEWERAGE AND DRAINAGE BOARD

AVON-SOUTH COAST WATER SUPPLY : CONTRACT NO. 3473-W-

TENDERS are invited for the MANUFACTURE, SUPPLY, TESTING, DELIVERY and INITIAL MAINTENANCE of six 24in. diameter, Two 18in. diameter, One 12in. diameter, Thirty-two 8in. diameter, and Twenty 6in. diameter, MANUALLY-OPERATED STOP VALVES.

Tender documents, including the Specification, can be obtained on application to the Agent General for New South Wales, 56, Strand, London, W.C.2.

Tenders must be submitted to the Metropolitan Water Sewerage and Drainage Board at 341, Pitt Street, Sydney, New South Wales, Australia, by 2 p.m. on Tuesday, 20th December, 1960. E7277

HEAVY ELECTRICALS LIMITED

MACHINE TOOLS

Heavy Electricals Ltd., Bhopal India invite TENDERS Nos. PP/F/MT/60/15 & 16 for MACHINE TOOLS. Tender Forms and Specifications are obtainable from Heavy Electricals Ltd., Crown House, Aldwych, London, W.C.2. on payment of £2 5s. and £1 10s. per set respectively, which is not refundable.

Tenders are to be submitted as specified in the Tender Forms. The closing date is 10th February, 1961. E7237

SUDAN GEZIRA BOARD

TENDERS

The Sudan Gezira Board invites TENDERS for the SUPPLY of the following :

TWELVE PRESSED STEEL TANKS, 12ft. by 12ft. by 12ft. deep of standard construction, centrifugal pumps, galvanised pipes and pipe fittings.

Interested Suppliers should apply to The Sudan Gezira Board Representative (U.K.), Castle Chambers, Castle Street, Liverpool, 2. For Specifications and conditions as soon as possible, as the closing date in the Sudan is 14th January, 1960. E7264

EDUCATIONAL

CHESHIRE EDUCATION COMMITTEE

CHESHIRE COUNTY TRAINING COLLEGE, ALSAGER, STOKE-ON-TRENT

ONE-YEAR COURSE OF TEACHER TRAINING FOR CRAFTSMEN

Cheshire Local Education Authority, with the approval of the Ministry of Education, will provide at the above-named College from September, 1961, a one-year course designed to give skilled Craftsmen teacher training to enable them to take up posts as teachers of Handicrafts in Secondary schools.

Applications are therefore invited for admission to this course from men who already possess appropriate qualifications, such as a Full Technological Certificate of the City and Guilds of London Institute, or a Higher National Certificate or Higher National Diploma, and who wish to be trained as teachers.

The particular academic requirements of individual students and the application of their craft skills to the needs of schools will be specially studied. The year of training will include periods of teaching in schools.

The basic salary for qualified assistant teachers is £520 per annum, rising by annual increments of £27 10s. and one final increment of £40 to a maximum of £1000. Additional increments are given for approved qualifications and training. Account may also be taken of approved industrial experience acquired over the age of 21, up to a maximum of 12 increments.

Anyone needing further advice about the course, the qualifications required, the grants available to students while attending the course, and the teaching prospects available at the end of the course, should communicate with the Principal. Applications for admission to the course should also be made to the Principal. Early application is advised.

JOHN G. KELLET,
Director of Education.

County Hall,
Chester. E7279

IMPERIAL COLLEGE

MECHANICAL ENGINEERING DEPARTMENT

Short course on the elements of the theory of plasticity with applications to metal working processes, from 10th to 14th April, 1961.

Fee : 10 guineas.

Further details from the Registrar, Imperial College, London, S.W.7. E7233 r

A.M.I.MECH.E., B.SC., City and Guilds, &c. Guarantee Postal Courses for all Exams. and Technical Divisions from Elementary to Degree standard including Automation Techniques. Approximately 95 per cent. successes. 148-page, prospectus free on request.—B.I.E.T. (Dept. 22), 29, Wright's Lane, London, W.8. E114 r

SITUATIONS VACANT

APPLICANTS ARE ADVISED TO SEND COPIES NOT ORIGINALS OF THEIR TESTIMONIALS UNLESS OTHERWISE REQUESTED.

BRITISH OXYGEN COMPANY LIMITED

ASSISTANT DEVELOPMENT ENGINEERS

DESIGNER DRAUGHTSMEN

B.O.C. wish to strengthen an important development department in their Technical Division at Cricklewood by the appointment of :

1. ASSISTANT DEVELOPMENT ENGINEERS : Candidates should be Graduate Mechanical Engineers or equivalent, and have had experience of original design and development work. In addition to mechanical engineering, experience in electrical, hydraulic and/or pneumatic systems would be an advantage.

2. DESIGNER DRAUGHTSMEN : Candidates should have a Higher National Certificate in mechanical engineering and be capable of designing prototype and production machinery.

The team is engaged in interesting work on the development of special purpose production machinery. There are ample opportunities for seeing original ideas through to the production stage.

Attractive salaries are offered to suitable candidates and there are good opportunities for advancement. A contributory pension scheme is in operation. Housing assistance is available. Replies, which will be treated in confidence, should give details of age, present salary, qualifications and experience, and should be addressed to the

Staff Officer,
B.O.C. Ltd.,
Bridgewater House,
St. James, S.W.1.

E7221 A

SITUATIONS VACANT

AN EXPERIENCED TECHNICAL REPRESENTATIVE, with sound knowledge of Gears and Transmissions of all types, is required by an old established engineering firm in the West Riding of Yorkshire. Good salary and pension facilities to suitable man.—BOX No. E3098, " The Engineer." A

CHIEF DRAUGHTSMAN. First class designer required for this post with firm of General Engineers in Bristol. Good knowledge of design of Pressure Vessels and stainless steel fabrications, with particular reference to the requirements of BS.1500. This will be a well paid position for the top class man. —BOX No. E199, " The Engineer." A

COMPANY COST CONTROLLER

A Company Cost Controller is required by a large Engineering Company to work on the Headquarters Staff. He will be responsible for checking the operations of financial controls, ensuring correct and timely compilation of cost reports and budgets and, in general, checking on the functioning of Management Accounting throughout the Company. He must be a highly-qualified Accountant with deep and extensive experience of Works Accounting, and already have several years' experience in positions of responsibility. Cost consciousness must be his dominant characteristic, and reduction of costs his constant goal.

A man of wide professional and industrial experience will find this post a spur to personal achievement. Salary will be generous for the right man, who should be between 35 and 48 years of age. His task is to make a major contribution to the carrying out of the Company's financial policy.

A man of personality plus high technical experience is required for this key post.

Applications, which will be treated in the strictest confidence, stating age, experience and qualifications to BOX No. E7253, " The Engineer."

A

SITUATIONS VACANT

CIVIL ENGINEERING ASSISTANT required for the Jamaica Office of Norman & Dawbarn, Architects and Consulting Engineers, 7 Portland Place, London, W.1, for civil engineering work associated with varied building projects including airports and factories. Written applications giving age, experience and qualifications are required. Salary, plus allowances, from £1850 to £2300 p.a. E3099 A

COMPRESSOR SALES ENGINEER based in London area required by large engineering firm manufacturing high speed rotary compressors. Successful candidate must be prepared to travel on occasion throughout the U.K. and Continent to expand applications for a unique type of compressor in all major industries, and to work at executive level.—Write to BOX No. E7241, " The Engineer." A

ELECTRICAL SALES ENGINEER

Engineering Company in Commonwealth West Africa importing Electrical Machinery and Equipment manufactured by firms of world wide repute requires an Engineer capable of developing the sales of these products in a rapidly expanding market. Salary and Allowances according to qualifications and experience will not be less than £1750 per annum. Applicants who should be under 35 must have had experience in the selling field, backed by a wide practical experience. Qualifications should be at least to H.N.C., but preference will be given to Chartered Engineers. Terms of Service include free medical attention in West Africa and an initial kit allowance, contributory Pension Fund, furnished accommodation at nominal rent, and free passages for wife and children where applicable. Tours of about 21 months followed by good home leave on full pay.—Apply, giving particulars to BOX No. E7260, " The Engineer."

A

ENGINEER SURVEYORS for the inspection of boiler and pressure plant required. Applicants should not be more than 38 years and must have 1st Class M.O.T. Certificate with steam endorsement or equivalent qualifications. Salary : E.S.A. Scale starting at £800 per annum. Other benefits. Areas : Oxford, Reading, South Bucks.—Apply Eng. Dept., GENERAL ACCIDENT ASSURANCE CORP., LTD., 99, Aldwych, W.C.2. E7251 A

FIRST CLASS ENGINEER with experience of high velocity Air drying systems as applied to Paper and Board, to take up a position in the U.S.A. in a rapidly developing department of a well-known American Company. Excellent opportunities and prospects.—Apply with particulars age, experience, &c., to BOX No. E3092, " The Engineer." A

FIRM OF CHARTERED QUANTITY SURVEYORS require TAKERS OFF and WORKERS UP for large Civil Engineering and Building works in the Sheffield area. Positions offer scope for advancement.—Reply, stating age, experience and salary required to BOX No. E3072, " The Engineer." A

KEEN YOUNG DESIGNER with engineering training wanted for Product Development involving new ideas and fixing specifications for bulk production. £1000 p.a. Opportunity with progressive Merseyside manufacturers.—Please reply to BOX No. E3102, " The Engineer." A

MAINTENANCE ENGINEER required for medium-sized Sugar Estate in Trinidad. Applicants should have sound experience of maintenance of Steam and Diesel engines and hold O.N.C., H.N.C., or equivalent certificate. Free furnished accommodation and medical care.—BOX No. E7249, " The Engineer." A

MANAGER for medium-sized Engineering Works in S.E. London. The post will entail responsibility for Production, Design and Drawing Office and Works Administration. The person appointed should be 30-35 years old and have sound technical and practical knowledge of M.S. Fabrications Machining, Fitting and Assembly Work. Experience of Hydraulic Press construction and/or Stainless Steel and Aluminium fabrications would be an added qualification.—Write, giving full details of experience, qualifications and salary to BOX No. E3104, " The Engineer." A

MECHANICAL ENGINEER, H.N.C. Standard, required for non-destructive testing of materials and vessels. Specialised training will be given to successful candidate. Progressive salary with non-contributory pension.—BOX No. E7257, " The Engineer." A

PERA requires staff for research into machining operations, including the economics of machining, evaluation of cutting tool materials and cutting fluids, analyses of tool wear, studies of chip formation, development of new machining techniques, &c. Applications are invited from engineers, physicists, or metallurgists (preferably of degree or H.N.C. standard) interested in machining research. Ability to think analytically and write clear concise reports is essential. The conditions of employment are attractive and there are excellent opportunities for advancement. Commencing salary commensurate with experience and qualifications. Superannuation scheme. Removal expenses paid.—Full details, including present salary in confidence to the Secretary (R.773), Production Engineering Research Association, Melton Mowbray, Leics. E7201 A

WORKS MANAGER for expanding medium sized factory Liverpool area specialising in mass production and finishing of pressure zinc base alloy diecastings. The successful candidate will be directly responsible to the Managing Director, have already proved himself by having successfully held a similar managerial post and be in the age group 35-45. Commencing salary will be £2000 to £2500 per annum and there is an opportunity for promotion. In addition to a first class engineering background, a knowledge of Production Control and Work Study is required together with ability to work to a budgetary control system. Experience in toolmaking is essential and a knowledge of press tool work and electro-plating would be an advantage.—Please write in the first instance to the Managing Director, Kredta Foundry & Engineering Co. Ltd., Woodend Avenue, Speke, Liverpool, 24. E7247 A

SITUATIONS VACANT

ROAD TRANSPORT VEHICLE MAINTENANCE FOREMAN, light and heavy vehicles. State wage and experience. Staff appointment with pension.—BOX No. E3103, " The Engineer." A

SALES CONTROLLER

A first class experienced Sales Executive is required by the Chairman of a large light engineering Group to co-ordinate the sales effort of the Company in all Divisions, and to ensure that sales operations are proceeding according to plan. He must have had extensive sales experience at top level and be able to control by checking sales operations and administration throughout the Company. He will collate and study sales budgets. He will inspect sales office and sales routines.

He must combine tact, toughness, and ability to deal with Directors and Managers at all levels with an outstandingly successful sales record.

This is a top sales job on the Chairman's staff of a fast moving Company, suitable to a man of high intelligence, commercial acumen, administrative ability, and personal toughness.

Candidates should be between 35 and 45 years of age and already earning at least £4000 per annum.

All applications will be treated in strictest confidence.

Please state age, experience and qualifications. —BOX No. E7252, " The Engineer."

A

WANTED by British Firm of Structural Engineers in Karachi (W. Pakistan) an ENGINEER experienced in design, shop fabrication, and erection of steelwork and able generally to handle structural contracts in all aspects. Excellent prospects.—Apply BOX No. E3100, " The Engineer." A

SITUATIONS FILLED

APPLICANTS TO " BOX NUMBERS " HAVE NO MEANS OF DISCOVERING WHETHER THEIR APPLICATIONS HAVE BEEN REJECTED OR MAY STILL BE UNDER CONSIDERATION. IF " BOX NUMBER " ADVERTISERS WILL ADVISE US WHEN A SITUATION HAS BEEN FILLED, WE SHALL BE PLEASED TO PUBLISH FREE A NOTE TO THIS EFFECT WITHOUT DISCLOSURE OF THEIR NAME.

BOX E3074, November 11 and 18, 1960 " Works Manager."

SITUATIONS VACANT

BROOK MARINE LIMITED

A Company in the Dowsett Group

HIGH SPEED SMALL CRAFT

Require capable and qualified DESIGNER for the Development of High Speed Planing Hulls and Hydroplanes.

Requirements :

(*a*) Age under 35.

(*b*) Engineering degree or equivalent.

(*c*) Extensive experience and proved ability in Hydrodynamics and Aerodynamics.

(*d*) Experience of normal practice in Naval Architecture advantageous.

Location : At Lowestoft, after an initial period at the Group's Central Development establishment in Lincolnshire.

Salary and Conditions : A liberal salary will be paid to the right man with excellent prospects for future promotion to positions of increasing responsibility as the work develops.

Applications which will be treated in confidence, should give full personal particulars and details of past and present experience and present level of remuneration to :— The Chairman, Brooke Marine Limited, Tallington, Stamford, Lincs.

E7230 A

Classified Advts. continued on page 128

BOOKS and PUBLICATIONS

BOOKS on ENGINEERING and allied subjects

★ NEW EXPANDED TECHNICAL DEPT. offers widest selection of books on these and similar subjects

DILLON'S UNIVERSITY BOOKSHOP LTD.
1 MALET STREET · LONDON · W.C.1 (MUSeum 2128)

Enter No. 1271 on reply card

ORDER YOUR COPY NOW!

" A complete library in two volumes . . ."

KEMPE'S ENGINEERS YEAR-BOOK *Edited under the direction of the Editor of " The Engineer "*

1961 Edition price **87/6** *(plus postage 2/6)*

from technical booksellers or direct from the publishers

Kempe's Engineers Year-Book, 28 Essex Street, Strand, London, W.C.2
Telephone : CENtral 6565

Enter No. 1272 on reply card

Electronic Engineering

A monthly journal for the professional electronics engineer. It circulates to 86 different industries all over the world.

When electronic engineering is studied " Electronic Engineering " is read.

28 ESSEX STREET, STRAND, LONDON, W.C.2
Telephone: Central 6565
Published by Morgan Bros. (Publishers) Ltd.

Enter No. 1273 on reply card

SITUATIONS VACANT

SENIOR DRAUGHTSMAN

MAY & BAKER LTD., DAGENHAM, ESSEX,

require a Senior Draughtsman with experience in the design and layout of chemical and similar plant installations. Applicants should have technical qualifications to Ordinary National Certificate level or higher. Salaries are reviewed annually. There is a Pension Fund and Life Assurance Scheme in operation. Excellent canteen and sports facilities.—Apply initially in writing to the Personnel Officer, quoting Reference No. 170/60.

E7242 A

SITUATIONS VACANT

DRAUGHTSMEN

We have a requirement for a large number of Designers and Draughtsmen at all levels experienced in :

Electronic and Computer equipment
Airframe Structures
Hydraulic Systems
Radio or Scientific Instrumentation
Structural, Mechanical & Electro-mechanical devices.

HOUSING ASSISTANCE MAY BE POSSIBLE

ATTRACTIVE SALARY PROSPECTS

Applications to be sent to :— Technical Personnel Officer, c/o Dept. G.P.S., English Electric House, Strand, London, W.C.2., quoting reference E1399W.

ENGLISH ELECTRIC AVIATION LTD.
Guided Weapons Division
London — Luton — Stevenage

E7263 A

SITUATIONS VACANT

ALLIS-CHALMERS GREAT BRITAIN LIMITED

have the following vacancies for draughtsmen :—

1. **CHIEF DRAUGHTSMAN**

to take charge of Drawing Office, engaged on agricultural and earth moving machinery design.

2. **SENIOR MECHANICAL DRAUGHTSMEN**

preferably with experience of Tractor or heavy vehicle design.

These are well paid appointments offered by a progressive and expanding Company. The work is varied and interesting, and the factory is pleasantly situated in the country with free local transport provided by the Company.

Applicants should apply to
the Chief Engineer,
ALLIS-CHALMERS GREAT BRITAIN LIMITED,
Essendine, Nr. Stamford, Lincs.

E7196 A

THE MOND NICKEL COMPANY LIMITED

requires

for development work in the ferrous field

STEELMAKER - METALLURGIST

with full practical melting-shop experience in the production of alloy steels, preferably including the austenitic stainless types. University degree or equivalent advantageous. The successful candidate will be located in London, but his duties will include foreign travel. Pension and assurance schemes are in operation and, in appropriate cases, assistance can be given for housing.

Applications, which will be treated in confidence, should give details of age, qualifications, experience, salary required, etc. They should be addressed to The General Manager, Development and Research Dept., The Mond Nickel Company Ltd., Thames House, Millbank, London, S.W.1. Please mark envelope " Confidential D.33."

E7179 A

BABCOCK & WILCOX LIMITED, LONDON

invite applications for the post of

DESIGN ENGINEER

for design of special pressure vessels. The work would involve interesting stress analysis and a close liaison with the Research Department, the Works, the Erecting Department and the Estimating Department of the Company in the solution of practical problems arising in the manufacture and erection of heavy pressure vessels.

A Degree in Mechanical or Structural Engineering is required and experience of stress analysis would be an advantage.

Applications, stating age, qualifications, experience and salary required should be addressed to :—

The Assistant Secretary,
209 Euston Road,
London, N.W.1.

E7235 A

CHIEF BUYER

for a nationally known company of heavy engineers in the Manchester area with a turnover in excess of £4,000,000 per annum. This senior executive appointment carries a service agreement and a starting salary up to £2000 per annum which is open to considerable advancement. Other benefits include a pension scheme with free life cover to date of joining and payment of reasonable costs of removal.

The Chief Buyer is a member of the Executive and directly responsible to the Managing Director for the activities of a department of approximately 20 staff. As sole purchasing agent, he is responsible for procuring, according to budget, all equipment and materials purchased on behalf of the Company and also for contributing to the reduction of unit costs by providing technical advice to design and manufacturing departments on alternative methods and materials. He will have complete authority over the staffing and salaries of his department, subject only to company policy.

Essential qualifications include an extensive knowledge of manufacturing methods obtained in medium to heavy engineering, experience of a unit highly organised in the application of modern management techniques plus wide experience of buying for such a company. Knowledge of contract law and personal ability to negotiate are highly desirable. Age 35-50.

Please write briefly in first instance, quoting Reference No. 933, to :

AA LTD

ASHLEY ASSOCIATES LIMITED
PETER HOUSE · MANCHESTER 1
Retained to advise on this appointment
THE STRICTEST CONFIDENCE WILL BE OBSERVED AND NO DETAILS OF CANDIDATES WILL BE PASSED TO CLIENTS WITHOUT CANDIDATE'S PERMISSION

E7240 A

SITUATIONS VACANT

Prominent and established Inventors and Manufacturers in London of special purpose precision machinery have decided to appoint a

STANDARDS ENGINEER

to be responsible to the Works Directorate for the expansion and operation of a Company Standards Department. The selected candidate will be a qualified Standards Engineer, of Engineering Degree level, aged 35—40, who is already practising successfully in this important field but is attracted to the concept of "a new world to conquer," and to the better financial rewards and prospects that we are prepared to hold out to him in consequence.

Applicants who can fit themselves to this descripton, should write in strict confidence giving all relevant data as concisely as possible, to

G. B. Salmon,
MOLINS MACHINE CO. LTD.,
Evelyn St., London, S.E.8.

E7226 A

SITUATIONS VACANT

ENGLISH ELECTRIC
STAFFORD

wish to recruit a number of STANDARDS ENGINEERS for their Central Standards Department. These vacancies are not only for Standards Engineers who wish to widen their experience but also for young Engineers, including Draughtsmen, who have completed their engineering training and who wish to make a career in this field.

The Department has extensive dealings with all the work in the Group and besides issuing Company Standards and Manuals much of the work is directly connected with the B.S.I.

Minimum qualifications required are an O.N.C. (Mech. or Elect.) for the junior and an H.N.C. for the senior posts, but consideration will be given in the latter cases to lesser qualifications if practical experience warrants it.

Details of housing assistance, the Company Pension Scheme, etc., will be given at interviews.

Please write giving full particulars to Dept. G.P.S., English Electric House, Strand, London, W.C.2. quoting reference E1294M.

E7254 A

SITUATIONS VACANT

PRODUCTION MANAGER

Required for a Company making domestic electrical appliances at Weston-super-Mare, employing 150 people. He will be responsible to the Managing Director for all aspects of Production and Works Management. This will include process planning, production control, shop supervision, maintenance and a small toolroom. Candidates should be between 30 and 45, be practical men with up to date knowledge of simple presswork, welding, painting and assembly operations for batch production.

Of particular importance is the ability to take responsibility for all aspects of planning and to be able to deal with production and tooling problems on the shop floor. Starting salary is £1,500—£1,750 per annum. Assistance will be given for removal expenses.

Applications, giving details of age, qualifications, experience and salary should be addressed in the first instance to:— Production-Engineering Ltd., 30 Waterloo Street, Birmingham 2. Names will not be revealed to present employers without permission.

E7256 A

S J & H

STEVENSON, JORDON & HARRISON, Ltd.
Consultants to Management

invite candidates to apply for admission as members of their staff in

1. PRODUCTION ENGINEERING

Qualifications : University degree or equivalent in Engineering. Five years in industry with not less than two companies and with specific experience in all or any one of the following :
(a) Methods Development (b) Work Study
(c) Production Control (d) Operational Research

Quote Ref. SJH/PE/En.

2. FINANCIAL CONTROL

Qualifications : Chartered-Certified or Cost and Works Accountant with specific experience in :
(a) Standard Costs (b) Management Accounting
(c) Systems Procedures (d) Computer Programming and Application

Quote Ref. SJH/FC/En.

Age Range 30-45

Opportunity will be provided, after 40 months' service, for appointment to Industry with a further opening later to return to Consultancy if desired. Substantial Salaries with Profit Sharing, Life Assurance and Pension Scheme.
Candidates should apply in confidence, quoting applicable reference, stating age, qualifications, education, experience and recent earnings to :

STEVENSON, JORDAN & HARRISON, LTD.
Consultants to Management,
Brook House, Park Lane, London, W.1.

Interviews will be conducted on 19th, 20th and 21st December
All applications will be acknowledged.

E7272 A

DESIGN ENGINEERS

Vacancies occur in the Mechanical Design Section of the Process Plants Division of Foster Wheeler Limited. The work involves the mechanical design of Heat Exchangers, Pressure Vessels, Process Piping (including thermal analysis), and the various special problems which arise in the design of Oil Refinery and Chemical Plant. Preference given to a Graduate Engineer having a minimum of two years' industrial experience, versatile, and with an aptitude for design. The position provides a wide range of interest, with full scope for original work in an integrated group. Salary will be commensurate with qualifications and experience. Pension and Life Assurance Scheme.

Write fully age, qualifications and experience to :—

Staff Department (M.D.O.D.),
FOSTER WHEELER LTD.,
3 Ixworth Place,
London, S.W.3.

E7246 A

SHELL BP

Shell-Mex and B.P. Ltd. have vacancies in the United Kingdom for an ENGINEER and DRAUGHTSMAN

The Engineer is required for the expanding Pipeline Department. His duties will include construction work and maintenance on an existing underground pipeline network.

Candidates should possess either Corporate Membership of the Institutions of Civil or Mechanical Engineers or have passed parts A and B of one of these Institutions' examinations or have qualifications entitling them to exemption from such examinations. A working knowledge of cathodic protection will be an advantage. Preference will be given to those under 35.

The Draughtsman should be able to work with the minimum supervision and will be responsible for visiting Installations and checking on site. Later on he will be required to produce working drawings for appending to contracts.

Conditions of employment in the company are excellent, and there is a particularly good pension scheme. Starting salary will depend on qualifications and experience. Replies should be sent to the address below quoting reference No. CA/127 in the case of the Engineer and reference No. CA/128 in the case of the Draughtsman. We regret that second applications cannot be considered.

The Staff Manager, Shell-Mex and B.P. Ltd.,
Shell-Mex House, Strand, London, W.C.2.

E7270 A

CANADA

EXCELLENT OPPORTUNITIES EXIST FOR ENGINEERS, SCIENTISTS & TECHNOLOGISTS

In the following fields :—

Aerodynamics
Hypersonics
Heat Transfer
Trajectory Analysis
Stability and Vehicle Dynamics
Theoretical and Experimental Research

Thermodynamics
Internal Ballistics
Heat Transfer
Combustion Studies
Unsteady Gas Flow Analysis
Theoretical and Experimental Research

Systems Analysis
Space Trajectory Analysis
Weapon-System Analysis
Mathematical Analysis

Systems Engineering
Weapon-System Optimisation
Computer Programming

Radiation Physics
Radiation Properties of Plasma
Spectroscopic Technique Development
Radiation Detector Development
Theoretical and Experimental Research

Plasma Physics
Electrical Properties of Plasma
Microwave Diagnostic Development Techniques
Theoretical and Experimental Research

Hypersonic Range Engineering
Range Design and Development
Experimental Test Engineering

Mechanical Engineering
Gun Systems Design
Projectile and Shell Design
Loading and Handling Systems

Instrumentation
Miniaturisation of Telemetry Systems
Transistor Circuits for Telemetry Applications
Design and Development of Electronic Equipment for Range Measurements

Interviews will be held very shortly in London

Applicants, preferably with some experience in the fields outlined above, should send in *immediately* full details of their personal histories, professional qualifications and experience together with a recent photograph if available to :—

THE REGISTRAR,
THE PROFESSIONAL ENGINEERS APPOINTMENTS BOARD,
201, HIGH HOLBORN,
LONDON, W.C.1.

E7220 A

Classified Advts. continued on page 130

SITUATIONS VACANT

CHIEF MECHANICAL ENGINEER

required by Medium Sized Engineering Company for their Llanelly Factory. To be Responsible to General Management for the design and development of the Company's products.

Applicants must be between the ages of 30/40 years and have thorough knowledge of general engineering principles and capable of basic design thinking. A good working knowledge of the design and installation of underground mining machinery would be an advantage.

Please apply in writing giving full details of qualifications, experience, present position held to General Manager, Crawley Industrial Products Limited, Llanelly, Carms. E7194 A

SITUATIONS VACANT

CONTRACTS ENGINEERS

are required by
W. H. ALLEN SONS & CO., LTD.
for their
PUMP DEPARTMENT

Due to expansion of the Department vacancies exist for two Contracts Engineers to handle projects, tenders and contracts for large pumping schemes.

Applicants must have served a recognised apprenticeship or post graduate training. One engineer should have had previous experience on pumps, have reached at least H.N.C. standard and be over 27. The other may be younger and less experienced but should have a University Degree or equivalent. Graduate membership of an appropriate professional Institution is desirable but not essential.

Conditions of service include a Contributory Pension & Life Assurance Scheme and assistance towards removal expenses where appropriate.

Applications in writing giving details of age, qualifications, previous experience and present salary, to :

THE PERSONNEL MANAGER
(Ref. 904/1)
QUEENS ENGINEERING WORKS,
BEDFORD. E7228 A

SITUATIONS VACANT

SENIOR STAFF TECHNICIAN

A vacancy exists in our Central London Design Office for a man with initiative and ability to undertake work on a very wide variety of engineering problems.

The position would appeal to an experienced aircraft stressman wishing to escape from specialisation and keen to accept a high degree of individual responsibility.

Familiarity with structural engineering requirements would be an advantage.

Write to

Design Director
MICROCELL LTD.
9 Kingsway, W.C.2.

E7273 A

PERSONNEL ADMINISTRATION LIMITED
MANAGEMENT CONSULTANTS

Our Appointments Division has been asked to advise on the following post :

SUPERINTENDENT ENGINEER **Ironfounders & Engineers**

for an old-established company in Central Scotland engaged in manufacturing a wide range of light castings. Responsible to the Board for directing and co-ordinating the activities of some 30 men in the Engineering and Maintenance Departments of a well-equipped mechanised Foundry. Candidates must have had extensive experience of plant and machinery maintenance in a responsible position. Foundry experience, though not essential, would be a distinct advantage. Qualities of drive and devotion to duty, coupled with the ability to handle men, are of great importance. Preferred age 35–45. Commencing salary up to £2,000 with Pension Scheme and life cover. (Ref. 4041/TE).

The identity of candidates will not be revealed to our clients without their prior permission.

For the convenience of clients and candidates we have Regional Offices in **Glasgow, Manchester, Bristol, Birmingham** *and* **Dublin** *but, in the first instance, applicants should forward brief details, quoting the reference number, to :*

PERSONNEL ADMINISTRATION, LIMITED,
APPOINTMENTS DIVISION, 2, ALBERT GATE, LONDON, S.W.1.

E7245 A

AEI

ASSOCIATED ELECTRICAL INDUSTRIES LIMITED
TURBINE-GENERATOR DIVISION

SENIOR DESIGN ENGINEERS

Applications are invited from Senior Design Engineers interested in a rewarding career in the field of large Steam Turbines for Power Stations.

Only experienced and highly qualified men are required.

The posts offer full scope and opportunities on challenging problems in a modern and expanding design organisation.

Write in confidence for appointment, quoting brief details of career to date to :—

Personnel Manager (M.17),
Associated Electrical Industries (Manchester) Ltd.,
Trafford Park,
Manchester, 17.

E7244 A

WORKS MANAGER
(Heavy Engineering)

for a medium-sized public Company in Lancashire manufacturing a wide range of medium and heavy equipment. Initial salary will be in the range £2000-£2500 per annum, plus bonus and other benefits, with excellent prospects of advancement.

The Works Manager, who will work directly to the Assistant General Manager, will have full control of all manufacturing units employing just over 500. His main initial functions will be to co-ordinate all sections from production planning to finished product, and to achieve maximum utilisation of labour, machines and capacity. The appointment is a challenging one and offers every scope for a man to use his technical and managerial skills to increase efficiencies.

Main requirements are an engineering apprenticeship, at least 5 years' direct practical experience in heavy precision engineering production on machining, welding, fabrication and assembly, and not less than two years at Production Superintendent level or above. Such experience should have been in a medium-sized organisation operating modern production and management techniques. A professional qualification would be an added advantage. Preferred age 38-50.

Please write briefly in first instance, quoting Reference No. 904, to :

AA LTD
ASHLEY ASSOCIATES LIMITED
PETER HOUSE · MANCHESTER 1
Retained to advise on this appointment
THE STRICTEST CONFIDENCE WILL BE OBSERVED AND NO DETAILS OF CANDIDATES WILL BE PASSED TO CLIENTS WITHOUT CANDIDATES PERMISSION

E727

GENERAL MANAGER —
METAL DEVELOPMENT ASSOCIATION

A Metal Development Association, which is a non-trading organisation with a world-wide membership, requires a General Manager to administer and expand the Association's services. These are principally concerned with providing information about the metal and stimulating interest in its uses, promoting new developments and assisting users in the solution of their problems. The staff numbers about 20.

Candidates should have a University education, a good presence and preferably some experience of promotional activities on a similar scale and in an international context. Some foreign travelling would be involved.

The post is non-technical but a technical background would be helpful. A flair for writing and speaking and some knowledge of languages, although not essential, would be additional assets. Starting salary £3,000/£3,500 ; pension scheme. Preferred age 35/50.

Reference Number 132.

RESIDENT ENGINEER (U.S.A)

Well-known British manufacturers of specialty agricultural equipment wish to appoint an enterprising and self-reliant young Engineer to their American Associated Company to take charge of Technical Services. He should be of at least H.N.C. standard, and capable of reading and interpreting agricultural transmission drawings and designing modifications to suit the U.S.A. market. He would be directly responsible to the Manager of the American Company who is an Englishman, and be supported by four Sales Engineers who are also British. Initial training for 4-5 months in England, then 4 months of understudy work in the U.S.A. prior to taking over the post. Salary during training : £1,250 in Europe : $6,600 in U.S.A. Starting salary on assumption of full duties : $7,200. Car provided and free transport for wife and family if married. Preferred age 26/33.

Reference Number 136.

Please reply in confidence quoting reference number to :—

C Robert Clive (Consultants) Limited

Appointments Consultants,

27, ALBEMARLE STREET, LONDON, W.1

E7223 A

SITUATIONS VACANT

Electrical Development Engineer

required by

F. PERKINS LTD., DIESEL ENGINE MANUFACTURERS

Applicants should be of H.N.C. standard or G.I.E.E. and should have experience in the design, development and use of special purpose instruments. A good general knowledge of internal combustion engines is desirable.

The main functions will be the development of electronic and electrical instruments for use on High Speed Diesel Engines.

We offer good salary, three weeks' holiday and modern welfare facilities.

Applications should be made in writing to Staff Officer, Eastfield Factory, Peterborough, giving details of age, experience etc. and salary expected.

E7267 A

SITUATIONS VACANT

UNITED KINGDOM ATOMIC ENERGY AUTHORITY

requires

DESIGN ENGINEERS

to work in close liaison with scientific staff on the design of experimental facilities and equipment for the Materials Testing Reactor at Dounreay.

Applicants must have served a recognised engineering apprenticeship and be at least graduate members of a senior engineering institution, or have an honours degree in engineering with at least three years' experience of light mechanical engineering

Salary assessed between £860 and £1825 according to age, qualifications and experience.

Housing assistance schemes. Hostel accommodation. Contributory Superannuation.

Send for Application Form to Personnel Manager, U.K.A.E.A., Dounreay Experimental Reactor Establishment, Thurso, Caithness, quoting Ref. 162/25.

E7232 A

SITUATIONS VACANT

WATER ENGINEER

A leading and old established firm of CONSULTING ENGINEERS in MALAYA, wishes to appoint a WATER ENGINEER of outstanding ability, for an important position.

Specialised experience of water supply and sewerage, and Corporate membership of an appropriate Institution essential, and preferably with a University degree.

Age: 45-55. A three years' contract with first class salary together with substantial benefits is offered. Applicants will be interviewed in London by a senior partner of the firm.

Full details quoting Ref. V.4437A should be sent to :—

The Registrar,
PROFESSIONAL ENGINEERS APPOINTMENTS BOARD,
201, High Holborn,
London, W.C.1.

E7219 A

FOR HIRE

LATTICE STEEL ERECTION MASTS (light and heavy), 30ft. to 150ft. high, for immediate hire. —Bellman's, 38 Cornwall Gardens, London, S.W.7. Western 3033. E197 g

MOBILE LIFTING SERVICE. Lump Sum or Hire Rate quoted for any lifting work by Lorry-Mounted or Crawler Cranes, any size, any area.—MOBILE LIFTING SERVICES LTD., A member of the TARMAC Group, Rotherham 78481. E186 k

SUB-CONTRACTING

KELLERING AND CAM PROFILING capacity up to 8ft by 6ft or 6ft diameter.—ARMYTAGE BROS. (KNOTTINGLEY), Ltd., The Foundry, Knottingley, Yorkshire (Telephone: Knottingley 2743/4). E116 MW

KELLERING AND COPY MILLING CAPACITY available up to 10ft. by 5ft.—British Federal Welder & Machine Co. Ltd., Castle Mill Works, Dudley, Worcs. Telephone: Dudley 54701. Thorpe Works, Egham, Surrey. Egham 3844. E7208 MW

PRATCHITT BROTHERS, LTD., Denton Iron Works, Carlisle, having well-equipped engineering shops and ironfoundry, invite enquiries for General Engineering, Structural and Platework, from firms wishing to have plants made to their own designs and specifications. E125 MW

RESEARCH DESIGN and DEVELOPMENT

NORRIS BROS. LTD.,
53 VICTORIA ST., LONDON, S.W.1.
Tel.: ABBey 6132,
and at Burgess Hill, Sussex,
Specialists in
RESEARCH, DESIGN, DETAILING AND DEVELOPMENT
throughout the whole of the Engineering Industry
E194 RD

MISCELLANEOUS

TIME RECORDERS, Sales, Rentals, Service, Telephone Hop 2239.—Time Recorder Supply and Maintenance Co., Ltd., 157-159, Borough High Street, London, S.E.1. E110 t

FORD

have the following vacancy

SENIOR PROJECT ENGINEER DESIGNER: Applicants must have had experience of Gas Booster, Coal and Coke handling and by-products plant installations. A comprehensive training in this field is essential. Successful applicants will be expected to have held a position of authority for at least two years and be capable of preparing tender drawings, specifications, bills of quantity and site supervision.

Please write giving details of age, qualifications and experience and quoting reference KGB to :—

H G PEARMAN · TRAINING AND RECRUITMENT DEPARTMENT FORD MOTOR COMPANY LIMITED · DAGENHAM · ESSEX

E7236 A

SENIOR ELECTRICAL DESIGN DEVELOPMENT ENGINEER

A man of live personality required by a leading manufacturer of rotating electrical equipment to implement the expansion of the Development Department of a company situated in the Midlands.

Applicants will be judged on creative ability, leadership and capacity to progress in a live organisation.

Some years' design experience on A.C./D.C. rotating machines is required, backed up by a professional qualification or university degree; a minimum attainment of H.N.C. may be acceptable.

This appointment carries a high commencing salary and opportunity for advancement.

A contributory pension scheme is in operation.

Applications, which will be treated in the strictest confidence, should contain full details of career and be sent to BOX No. E3087, "The Engineer." A

MSL *have been retained to advise on the appointment of a*

COPY EXECUTIVE
Technical

for a well known engineering organisation which specialises in the production of technical and scientific literature and every kind of sales promotional aid and material used in the engineering, electrical, electronic and nuclear industries.

The copy executive will take over all responsibility for the writing of 'copy' for technical press advertisements and sales promotion literature, the subjects covering the entire field of engineering and science. The standard of work required is exceptionally high and the man appointed will have adequate support from a large staff of specialist engineers.

Candidates must have :

1. A sound engineering background—preferably a recognised technical qualification.
2. The ability to write faultless English (including spelling, punctuation and grammar).
3. Practical knowledge of sales promotion in the technical field.

Experience in handling the publicity of a large engineering company desirable. Probable age 30 to 35. Initial salary up to £1500 plus bonus and contributory pension scheme. Please send brief details in confidence quoting reference G.2694 to P. J. H. Fryer.

MANAGEMENT SELECTION LIMITED
17 Stratton Street, London, W.1.

In no circumstances will a candidate's identity be disclosed to our client unless he gives permission after a confidential interview at which he will be given full details of the appointment.

E135 A

AGENCIES

AGENTS WANTED. Progressive paint manufacturing company with extensive programme for development of industrial business, requires well introduced Agents who must be ambitious and able to appreciate a real opportunity when they see one. The need is for enthusiastic self-reliant and energetic men who are exceptionally well connected. Remuneration by arrangement.—Write BOX No. E3086, "The Engineer." D

BUSINESSES and PREMISES

ENGINEERING WORKS For Sale with long-established overseas connections. Ideally situated in Tyneside area.—Apply BOX No. E3096, "The Engineer." L

GATESHEAD
Modern Factory.
Approximately 21,000 square feet
All modern services
Internal height 20 feet
Prominent position
Details: KNIGHT, FRANK & RUTLEY, 20 Hanover Square, W.1.
MAY 3771 E7268 L

PATENTS

THE PROPRIETOR of British Patent No. 628891, entitled "ROTARY CRUSHING MILL" offers same for license or otherwise to ensure practical working in Great Britain.—Inquiries to Singer, Stern & Carlberg, 140 So. Dearborn Street, Chicago, 3, Illinois, U.S.A. E7204 H

THE PROPRIETOR of British Patent No. 712503 entitled "IMPROVEMENTS IN MACHINE FOR PRODUCING AND PACKAGING WIRE FORMS," offers same for license or otherwise to ensure its practial working in Great Britain.—Inquiries to Singer, Stern & Carlberg, Chrysler Building, New York 17, New York, U.S.A. E7205 H

WANTED by N.W. Engineering Firm in Manchester Area. Patent to Purchase or Operate under Licence suitable for Modern Size Works with Machining and Fabricating capacity.—BOX NO. E3097, "The Engineer." H

THE PROPRIETOR of British Patent No. 715619, entitled "METAL WORKING MACHINES AND OPTICAL PROJECTION APPARATUS THEREFOR" offers same for license of otherwise to ensure practical working in Great Britain.—Inquiries to Singer, Stern & Carlberg, 140 South Dearborn Street, Chicago 3, Illinois, U.S.A. E7227 H

MSL *have been retained to advise on the appointment of a*

HEAD OF DESIGN

to be accountable to the Works Director for all design and project work for a company employing over 300 people, manufacturing industrial washing, pressing and dry-cleaning machinery.

Requirements: Preferred age 30 to 40. Grammar or public school education followed by degree or professional qualification in mechanical engineering. Design experience of laundry machinery or similar plant would be an asset, and a knowledge of the problems of casting, fabrication, heat transfer and the application of air, hydraulic and electric power would be valuable.

Rewards: Salary at least £1,500. Three weeks leave. Pension and life assurance. Rural location, with fishing, sailing, climbing, and golf available in the vicinity. Please send brief details in confidence quoting reference G.9101 to D. C. Duncan.

MANAGEMENT SELECTION LIMITED
17 Stratton Street, London, W.1.

In no circumstances will a candidate's identity be disclosed to our client unless he gives permission after a confidential interview at which he will be given full details of the appointment.

E134 A

For Sale by Private Treaty

EQUIPPED ENGINEERING WORKS

50 Miles South of London

FREEHOLD MODERN FACTORY

Floor Space of 37,700 sq. ft.
Site Area of 2·3 Acres
together with the
MACHINE TOOLS, PLANT & EQUIPMENT,
Company's Name and Tax Losses.

Price £180,000

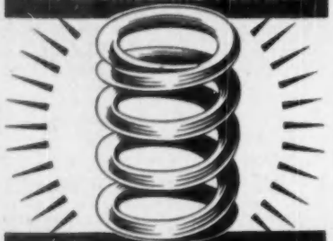
Full Particulars of Sole Agents :

HENRY BUTCHER & CO.,

73 Chancery Lane, London, W.C.2.
Tele : Holborn 8411 (8-lines) E7266 L

Classified Advts. continued on page 132

SPRINGS AND SPRING WASHERS
FOR ENGINEERING PURPOSES



Manufactured by
JOHN TONKS & CO LTD.
CENTRAL SPRING WORKS
Furnace Hill, SHEFFIELD, 3
Telephone: SHEFFIELD 24679 Telegrams: TONKS, SHEFFIELD 3

Enter No. 1321 on reply card

THERMOSTATIC VALVES

for
CONTROLLING STEAM SUPPLY TO HOT WATER CALORIFIERS, Etc.

The HORNE ENGINEERING Co. Ltd.
35 PITT STREET, GLASGOW

Enter No. 1322 on reply card

SCOTTISH AVIATION LTD

For
- DESIGN AND MANUFACTURE OF AIRCRAFT COMPONENTS
- DESIGN AND MANUFACTURE OF JIGS AND TOOLS
- DESIGN AND MANUFACTURE OF GLASS FIBRE COMPONENTS
- SHEET METAL FABRICATION IN LIGHT ALLOY OR STEEL
- PROTECTIVE TREATMENT, STOVE ENAMELLING
- ALL TYPES OF MACHINE SHOP WORK

Send your enquiries to—

SCOTTISH AVIATION LTD
PRESTWICK AIRPORT · AYRSHIRE
'PHONE: PRESTWICK 79888 (20 lines) TELEX: 77432
CABLES: AERONAUTICS PRESTWICK

Enter No. 1323 on reply card

CORONA REGISTERED TRADE MARK

'CORONA'

Ettco BRITISH MADE

TAPPING ATTACHMENTS

Will fit any standard drilling machine with morse taper drive

Made in 3 sizes
Tapping capacity $\frac{1}{16}$" to $\frac{3}{8}$" dia.

Automatic reverse. Friction clutch drive
Tap idles in forward direction

Tap breakage practically eliminated

Telegrams 'Corona' Leicester

FREDK. POLLARD & CO. LTD.
CORONA WORKS, LEICESTER
ENGLAND

Telephone Leicester 67534 (5 lines)

LONDON OFFICE: Coastal Chambers, 15 Elizabeth St., Buckingham Palace Road, S.W.1

Enter No. 1324 on reply card

MACHINERY Etc. WANTED

WANTED FOR CASH all types of Electrical, Plant, A.C. & D.C. Motors, Diesel Generating Sets, Transformers, Turbo-Alternators, Cables Dismantling Staff Available.—ELECTRICAL PLANT & MACHINERY Co., 12 Hilton St., E.1. E5895 F

URGENTLY REQUIRED. One 16in. cylinder 4 wheel coupled saddle tank Steam LOCOMOTIVE 4ft. 8½in. rail gauge, preferably Yorkshire Engine manufacture.—Full details price etc. to:—G. E. Simm (Machinery) Limited, 27 Broomgrove Road, Sheffield 10. E7222 F

VERY URGENTLY REQUIRED TO PURCHASE

NCK 205 or similar EXCAVATOR. Preferably not more than 5-6 years old. Equipment immaterial. —Fullest details BOX No. E7248, "The Engineer." F

FOR SALE

SERVICE EDWARDS VALUE

KEETONA Universal Folding Machine, capacity 73in. by ¼in., with balance weight and adjustable stop for repetition angle bending, max. lift top beam 2¼in., max. radius with radius blades 1in., weight approx. 46 cwt.

FOUR BLACKBURN & CRAWSHAW Power Operated Geared Rotary Shearing Machines, capacity ¼in. thick, depth of gap 20½in., cutters diameter by thickness 5¼in. by ⅝in., cutting speed 51ft. 6in. per minute, arranged motor drive, 400/3/50.

BRADLEY & CRAVEN Press Brake, motorised for 400/440/3/50 supply, max. pressure approx. 65 tons, forming capacity 10ft. by 12 S.W.G. over die opening of ⅝in. or 8ft. by ½in. over die opening of 1¼in., tee slotted bed, length of bed and ram 120½in., width of bed 5in., weight approx. 8½ tons.

CRAIG & DONALD Deep Gap Guillotine Shearing Machine, motorised for 400/3/50 supply, with automatic hold-down and adjustable back gauge. capacity 14ft. by ¼in., complete with three spare sets of blades, weight approx. 11 tons.

BESCO Heavy Duty Double Geared Guillotine Shearing Machine, motorised for 400/440/3/50 supply, capacity 72in. by ¼in. mild steel plate, with automatic hold-down and front, back and side gauges, complete with one spare pair of blades, weight approx. 12¼ tons.

TWO NEW LEN100/320 Open Fronted Inclinable Power Presses, motorised for 400/440/3/50 supply, pressure exerted 100 tons, depth of throat 12⅛in., adjustment of stroke 13/16in. to 5¼in., table 23⅜in. by 35 ⅛in., hole in table 13⅛in. diameter, weight approx. 147 cwt.

TWO NEW LEN25/220 High Speed Open Fronted, Inclinable Power Presses, with adjustable stroke, motorised for 400/440/3/50 supply, pressure exerted 25 tons, depth of throat 8 ⅛in., table 16⅛in. by 22 ⅛in., hole in table 8⅛in., stroke adjustable from ⅛in. to 3 ⅛in., weight approx. 35 cwt.

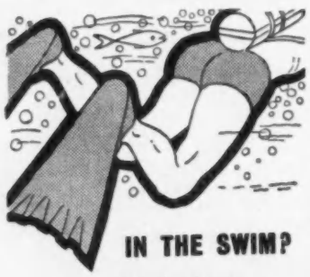
Photographs of the above are available.

Very favourable Hire Purchase terms can be obtained.

MACHINE TOOLS, NEW AND USED,
Of Every Description. Attractive Prices.

F. J. EDWARDS LTD.
359-361, EUSTON ROAD,
LONDON, N.W.1.
Telephone: EUSton 5000. Telex 24264
And at
LANSDOWNE HOUSE, 41, WATER STREET,
BIRMINGHAM, 3.
Telephone: Central 7606-8 E207 G

"SAMUEL PLATT" 800 LB. MOTORISED FRICTION BOARD DROP HAMMER for sale. Length of drop 5ft. Between uprights 14in. Size of anvil 17in. by 31½in. Electrical equipment for 400/440/3/50. Weight about 10 tons.—F. J. Edwards Limited, 359, Euston Road, London, N.W.1, or 41, Water Street, Birmingham, 3. E7276 G



IN THE SWIM?
You will be if you
remember **WARDS**
might have it!
THOS. W. WARD LTD
ALBION WORKS, SHEFFIELD

FOR SALE

600

FOR IMMEDIATE DISPOSAL

20-TON WAGON TIPPLER by Fraser & Chalmers, with all electrics, control panel, tippler emergency and emergency stop switches, Pooley weigher for 34 tons in 1 cwt. divisions, standard gauge rail platform 19ft. 6in. overall length, main tippler motor 20 h.p. driven through reduction gear.

Reply:

GEORGE COHEN,
SONS AND CO. LTD.
WOOD LANE, LONDON, W.12.
Telephone: Shepherds Bush 2020. E201 G

HYDRAULIC PRESSES
HYDRAULIC PUMPS

Hydraulic Accumulators, Valves, Fittings, New and Second-hand. Complete installations.
All kinds of Hydraulic Equipment in Stock.

THOMPSON AND SON (MILLWALL), LTD.,
Cuba Street, Millwall, London, E.14.
East 1844/5 E111 G

SOAG

offer

LARGE CAPACITY MACHINE TOOLS

A SELECTION FROM OUR STOCKS

DEUTSCHLAND 18in. by 30ft. Heavy Duty Centre Lathe with copy turning over full length. 3 Saddles with compound toolslides. Power traverse to saddles and tail stock by separate motors. Roller bearing spindle. Feeds by threaded shaft. 3-shear bed. Swing over bed 36in. Swing over slide 20in. 24 spindle speeds. H.P. motor 68.

NOBLE & LUND 48in. Centre S.S. and S.C. Lathe with front and back saddle on separate slides, rapid power traverse, swing over saddle 6ft. 8in., diameter face plate 8ft., between centres 10ft., 16 spindle speeds up to 40 r.p.m. H.P. main motor 30.

WARD No. 16 Combination Turret Lathe for chuck work, covered bed, motor drive, swing over bed 36in., over cross slide 25½in., spindle bore 9in., distance spindle nose to turret face 96in., 16 spindle speeds 7-225 r.p.m., h.p. motor 50.

BILLETER & KLUNZ 5ft. 9in. by 4ft. 11in. by 13ft. 2in. Double Column Planer, Type NDC IT. 4,000 with two tool heads on crossrail and one on each upright. Heid-Vulkan electro-magnetic Reversing Clutch drive and 9-speed gearbox.

CRAVEN Double Column, 4ft. 3in. by 4ft. 3in. by 20ft., two heads on crossrail and one sidehead, A.C./D.C. variable speed drive, Push button control, width of table 3ft. 9in. cutting speed 30-180ft. per min.

CVM40 KENDALL & GENT Vert. Miller, multi-motor drive in spindle, table feeds and rise and fall of spindle head. Table working surface 8ft. by 2ft. Capacity 8ft. by 2ft. by 2ft. 6in., spindle speeds 30-80ft. per min. Main motor 15 h.p. with power-operated rotary table 3ft. dia.

MUIR 90in. Model M.T.9 Heavy Duty Large Capacity Hobber, for spur, spiral and helical gears and worm wheels, maximum diameter of spur gears and worm wheels 90in., maximum diameter of spur gears running at high speed 72in., maximum spiral diameter with maximum width at 10 deg. angle 90in., maximum spiral diameter with maximum width at 45 deg. angle 70in., maximum spur and helical width 26in.-30in. according to diameter, maximum D.P. 1¼, table diameter 58in., range of hob speeds 18-80 r.p.m., h.p. main motor 12.

SCHMALTZ R6/5000 Plain Cyl. Grinder, capacity 24in diameter by 16ft. 7in., with Multi-motor drive, mechanical table feeds, hydraulics. Rapid traverse to wheel head, Int. Grinding attachment. New 1952, little used.

INSPECTION INVITED.

Full details from:

SOAG MACHINE TOOLS LTD.,
JUXON STREET, LAMBETH, LONDON, S.E.11.
'Phone: RELiance 7201.
'Grams: "Sotoolsag," London, S.E.11.
E7239 G

FOR SALE

FRED WATKINS (ENGINEERING) LTD.

STEAM BOILERS.—Cochran Vertical (New) 7ft. and 6ft. 6in. dia., 150 lb. w.p.; reconditioned 9ft. down to 3ft. dia.; Economic 4ft. to 11ft. 6in. dia., including new 8ft. dia., 150, 180 and 200 lb. w.p.; 300 reconditioned Vertical Crosstubes, all sizes.

AIR COMPRESSORS.—Two Belliss & Morcom 2500 c.f.m., 100 p.s.i., 550 h.p. motors; also Broomwade 500, 400, 300, 200 and 130 c.f.m., all motorised; and several other of various makes and capacities.

200 AIR RECEIVERS, stocked up to 9ft. dia., 100 to 500 lb. pressure.

ELECTRIC MOTORS.—150 Totally Enclosed and Flameproof Motors up to 200 h.p.

MOBILE ROAD CRANES.—10-ton Lorain lorry-mounted 30ft.–70ft. extendible jib; 8½-ton Ransome Diesel/Electric 21ft. jib; 6-ton Coles Diesel/Electric, solids; 4-ton Coles Diesel/Electric, solids, 1945; 3-ton Jones "Super 40" diesel, pneumatics (3).

OVERHEAD CRANES.—25-ton Girders and end carriages, with 60 h.p. motors, 95ft. 10in. span; 30-ton Vaughan, 42ft. 3in. span; 25-ton Clyde, 21ft. 9in. span, new 1954; 20-ton Vaughan, 42ft. 3in. span, 6-ton auxiliary, cab control (5); 20-ton King, 42ft. 3in. span, 400/3/50; 10-ton Heywood, 34ft. span, unused; 10-ton Morris, 32ft. 10in. span, 400/3/50; two 10-ton, 60ft. span, 1955; two 7-ton, 37ft. span, 1950; Wharton, 7½-ton, 25ft. span, 400/3/50; 5-ton, 37ft. span, 1944; 5-ton Henderson, 24ft. 7in. span, 1946; 5-ton King, 29ft. 3in. span, power hoist, hand travel; 5-ton Morris, 28ft. 6in. span, power hoist, hand travel; 4-ton Morris, 19ft. span, 220V. d.c.

DERRICK CRANES.—7-ton Henderson, 110ft. jib, electric, 1952; 7-ton Anderson Grice, 100ft. jib, electric; 1½-ton Anderson Grice, hand, 40ft. jib; 5-ton Butters Grabbing, 80ft. jib, electric.

RAIL CRANES.—18-ton Brownhoist, steam, 50ft. jig; 10-ton Grafton, 34ft. jib, diesel conversion; 8-ton Wilson, steam, 35ft. jib; 5-ton Smith, 50ft. jib (2).

LOCOS.—Fowler diesel, 150 h.p. (2); Barclay & Ruston, 80/88 h.p. diesel; Bagnall, 14in. by 22in. (two oil-fired, one coal), Peckett steam, 7in. by 12in., 1941; 4 Logan Battery-operated, 24in. gauge, 3-4-ton cap.; 3 Ruston diesel 16/20 h.p., 24in. gauge; also 2 miles 20 lb. and 1200 yds. of 25 lb. by 24in. gauge track, Bogies, Wagons, &c.

STEEL PIPING.—Large stocks including following: 20,000ft. 1¼in. galvanised "A"; 20,000ft. scaffolding; 30,000ft. 3in. black; 15,000ft., each 6in., 3/16in., ¼in., 5/16in., unused; 5000ft., 8in. unused; 2000ft., 10in., 12in., 16in., seamless; 200ft., 24in. by ¼in. welded, unused; 1000ft., 30in. by ¼in. welded, unused; 2500ft., 27in. welded flanged; 500ft., 36in., unused; 500ft., 42in. by ¼in. riveted; 100ft., 48in. by ¼in. welded, unused; 150ft., 60in., welded; 20in., 24in., 26in., 27in., 28in., bitumen lined, unused. Full list on request.

CAST IRON PIPES.—Large stocks all sizes up to 24in. flanged and s.s., including 150 by 18ft. lengths, 6in. Stanton class "B" Spigot and Socket, unused. Immediate delivery.

VALVES.—Exceptional Surplus Ministry Lot. New Stainless Acid Cocks and Valves, over 5000, immediate delivery, below makers' prices. Large stock all sizes, Parallel Slide Sluices, Gunmetal, Reducing and Check Valves. List on request.

STORAGE TANKS.—300 cylindrical and rectangular, up to 12,000 gallons for oil and petrol, also sectional steel and cast iron up to 50,000 gallons.

MACHINE TOOLS.—Heenan & Froude Dynamometers, 1500 h.p. maximum, 18in. Dial Indicator (three) Scriven Plate Bending Rolls, 14ft. by ¼in.; Pels Punch and Shears, ¼in. capacity; nine new 2 cwt. and 1 cwt. Pneumatic Hammers; Bonn Hydraulic Tube Bender up to 20ft. by 4in. bore; Berry Guillotine capacity 4ft. by 1in.; Sedgwick 6ft. by ¼in. Folding Machine; Rushworth Guillotine, 6ft. by ¼in., Bliss 70-ton power press; 3 Bliss No. 304 vertical single action drawing presses, 7¼in. stroke; 7ft. by 1in. Plate Flattening Rolls; 9 roller flattener, 2ft. by ¼in. capacity.

AUTOCLAVES.—Two 26ft. by 9ft. dia. hinged doors; new 1948, about 45 lbs. working pressure; jacketted autoclave, 12ft. by 7ft. diameter, bolted lid, approx. 60 lbs. steam pressure.

SLING ENGINEERING WORKS
COLEFORD, GLOS.
Phone: Coleford 2271/2 E106 G

HYDRAULIC PRESSES

200-ton Fielding, 42in. stroke, 63in. daylight (five off).
100-ton Fielding, 72in. stroke, 99in. daylight.
50-ton Fielding, 24in. stroke, 48in. daylight.
200-ton Tangye Vertical open fronted, 21in. stroke, table 24ft.
80-ton Musgrave Vertical upstroke, 42in. daylight, platens 72in. diameter.
Fielding Horizontal, 24in. stroke, bend up to 8in. pipes.

All complete with pumps and motors.

FRED WATKINS (ENGINEERING) LTD.
COLEFORD, GLOS.
'Phone Coleford 2271/5. E193 G

SPECIAL OFFER

5-ton CARRUTHERS E.O.T. CRANE, 76ft. 6in. span, 39ft. 6in. height of lift, 440 volts, 3-phase, 50 cycle electrics. New 1951 and as new. Low price for Sale ex-Site.

G. E. SIMM (MACHINERY) LIMITED,
27 Broomgrove Road, Sheffield, 10.
Telephone No.: 6443 (5 lines). E7185 G

AUCTIONEERS & VALUERS

HENRY BUTCHER
AND CO.

Auctioneers, Valuers and Surveyors

Specialising
in the
SALE & VALUATION
of
ENGINEERING & ALLIED WORKS
PLANT & MACHINERY

73, Chancery Lane, London, W.C.2.
HOLBORN 8411 (8 lines)

Established 1807

FULLER, HORSEY
SONS & CASSELL

Specialists
IN THE
SALE & VALUATION
OF
WORKS and MANUFACTORIES
ENGINEERING PLANT
and MACHINERY

10, LLOYD'S AVENUE,
LONDON, E.C.3.
Telephone: ROYAL 4861

JOHN FOORD
& COMPANY

VALUERS AND ASSESSORS
OF WORKS, FACTORIES
ENGINEERING PLANT
AND MACHINERY

56, VICTORIA STREET,
LONDON, S.W.1.
VICTORIA 2002/3/4
Established Over a Century

FOR SALE

FOR SALE

Number of Diesel Sets, many unused, from 1100kVA downwards. Also large stock of alternators; unused, reconditioned and guaranteed.

3-ton and 5-ton Overhead Travelling Cranes, hand-operated, suitable for power houses; unused.

Dynamometer by Heenan & Froude, 50/700 h.p., 450/3500 r.p.m.

Further particulars willingly given.

FYFE WILSON & CO., Ltd., Stati on Works Bishop's Stortford. E192 G

AUCTIONEERS & VALUERS

ESTABLISHED 1877

LEOPOLD FARMER & SONS

conduct

AUCTION SALES
and
VALUATIONS
OF PLANT, MACHINERY AND INDUSTRIAL PROPERTIES

FACTORY INVESTMENTS
MORTGAGES ARRANGED

46, GRESHAM STREET,
LONDON, E.C.2.

Telephone: Monarch 3422 (8 lines)
Telegrams: Sites, London

AUCTIONEERS & VALUERS

Established 1850

WHEATLEY KIRK PRICE & CO.

E. L. JUDSON, F.R.I.C.S., F.A.I.
E. BEDDARD, A.I.MECH.E., F.A.I.P.A.
M. S. CHEAVIN, F.A.I.
G. E. GIBBS, F.A.I.P.A.

SURVEYORS, VALUERS and AUCTIONEERS of FACTORIES, PLANT and MACHINERY

FIRE LOSS ASSESSORS

9, REX PLACE, LONDON, W.1.
Telephone: HYDE PARK 8844/5/6 (3 lines)

E R

By Order of the Secretary of State for War

GOVERNMENT SURPLUS STORES

SALES BY AUCTION

		Main Location	*Auctioneers*
December 13	**Machine tools and miscellaneous stores,** including:	W.D. Storage Depot, South West Stores, **Euxton Lane, Chorley, Lancs.** (Sale at Cheetham Town Hall, Manchester, 8.)	**J. H. NORRIS & SON** (Dept. L), 9, Albert Square, Manchester, 2. (Tel.: Blackfriars 8373.)

Denham, Pratt & Whitney, Southbend and other centre lathes; Ward No. 2A Denver No. 6R, Timbrell & Wright Nos. 2A and 3, Herbert Nos. 1, 3 and 4 capstan lathes; Gishalt No. 4 turret lathe, B.S.A. multi-tool lathe, Scrivener rough turn lathes; Hepburn, Oldfield & Schofield & Braithwaite facing, boring and recessing lathes; Kitson, Sentinel, Mann and other "C" type hydraulic lathes; Norton, Landis & Newall cylindrical grinders; Orcutt internal and external gear grinders; Cincinnati No. 2 universal cutter grinder; Hunt twist drill sharpeners; Noble & Lund saw sharpener; Edgwick horizontal miller; Wadkin, Archdale 3ft. and Town 4ft. radial drills; Asquith 4ft. 9in. portable universal radial drill; Sciaky 75KVA and British Federal 50 and 100KVA seam welders; bench drills; grinders and polishing spindles; Sturtevant rotary dryers; overhead conveyor; sectional buildings; canteen and camp equipment; hand tools; generator sets; industrial trucks; M.T. spares; tyres; furniture; trailer-mounted 150 c.m. searchlights; scrap batteries; paint; clothing and textiles, including greatcoats; scrap blankets; canvas, webbing and ground sheets.

1961 January 4	**Miscellaneous stores.**	Northern Command Ordnance Sub-Depot, **Barlow, Nr. Selby, Yorks.**	**BARTLE & SON** (Dept. L), 50-52, Merrion Street, Leeds, 2. (Tel.: 20898.)
January 11	**Machine tools and miscellaneous stores.**	Central Ordnance Depot, **Tidworth.** Central Ordnance Sub-Depot, **Devizes.** (Sale at Corn Exchange, Devizes.)	**FARRANT, WIGHTMAN & PINNIGER** (Dept. L), Market House, 2, Newport Street, Swindon. (Tel.: Swindon 5151/2.)
January 19	**Miscellaneous stores.**	W.D. Storage Depot, **Rotherwas, Hereford.**	**RUSSELL, BALDWIN & BRIGHT, LTD.** (Dept. L), 20, King Street, Hereford. (Tel.: 4366.)
January 27	**Miscellaneous stores.**	Command Ordnance Depot, **Coypool, Marsh Mills, Plymouth.** (Sale at Kinterbury House.)	**WOOLLAND SON & MANICO** (Dept. L), Kinterbury House, St. Andrews Cross, Plymouth. (Tel.: 69292.)
February 1	**Machine tool and miscellaneous stores.**	Technical Stores Depot, **Old Dalby, Leics.** (Sale at Melton Mowbray.)	**SHOULER & SON** (Dept. L), 1, Norman Street, Melton Mowbray, Leics. (Tel.: 3081.)
February 7–9	**Vehicles, earth-moving equipment, mobile cranes and motor cycles.**	W.D. Storage Depot, **Roddington, Notts.**	**WALKER, WALTON & HANSON** (Dept. L), Byard Lane, Bridlesmith Gate, Nottingham. (Tel.: 54272.)
February 10	**Miscellaneous stores.**	Returned Stores Group, **Reed Hall, Colchester, Essex.**	**FENN WRIGHT & CO.** (Dept. L) 146, High Street, Colchester, Essex. (Tel.: 73171.)
February 14–15	**Machine tools and miscellaneous stores.**	W.D. Storage Depot, **Royal Arsenal, Woolwich, London, E.18.**	**FULLER, HORSEY, SONS & CASSELL** (Dept. L), 10, Lloyd's Avenue, London, E.C.3. (Tel.: Royal 4861.)
February 23	**Vehicles and miscellaneous stores.**	W.D. Storage Depot, **Bowhouse, Hurlford, Nr. Kilmarnock, Ayrshire.**	**DIXON & WALLACE LTD.,** (Dept. L), Bank Buildings, Graham Square, Glasgow, E.1. (Tel.: Bridgeton 2447/9.)
February 28	**Miscellaneous stores.**	1 E.S.D., **Long Marston, Nr. Stratford-on-Avon, Warwicks.** (Sale at the Hippodrome, Stratford-on-Avon.)	**LOCKE & ENGLAND** (Dept. L), 166, Parade, Leamington Spa, Warwicks. (Tel.: 2833.)

Application for catalogues, available 14-days prior to date of sale should be made only to the auctioneers shown above (price of catalogue 1s.—P.O. only). E118 J

WELL, WHAT IS IT?

(To be fair we should point out that the domed top and fabricated cantilever are part of a test rig. The thing in question begins at the weld below the lettering).

Unless you happened to see, in an earlier advertisement, the cardboard model in which the idea took shape, memory will be no help. This is something quite new.

It is an expansion joint, one of 72 such joints that will take up the expansion of the CO_2 ducting at the Trawsfynydd Atomic Power Station. Internal pressure 265 p.s.i., temperature 420°C. The convoluted bellows holds the internal pressure; the end thrust—over 1,000,000 lb.—is taken by the inclined, high-tensile steel bars round the periphery; flexing is entirely by elastic straining of these bars. The illustration shows the joint being prepared for the Insuring Authority's acceptance test—1,250 full deflections under full internal pressure and temperature. Compared with previous joints for this kind of work it is lighter, simpler, cheaper. It is the kind of highly original solution to both new and old problems that Richardsons Westgarth engineers can, and frequently do, produce.

RICHARDSONS, WESTGARTH & CO. LTD.

The Controlling Company of The Richardsons Westgarth Group,
Wallsend, Northumberland, and at 58 Victoria Street, London S.W.1.

Associated with Atomic Power Constructions Ltd.

R.W.68

Enter No. 1341 on reply card

INDEX TO ADVERTISERS

PAGE

AB Atlas Copco/Sweden Cover ii
Acciaieria E Tubificio Di Brescia....114
Acrow (Engineers), Ltd.....2
Adamson, Joseph, & Co., Ltd.110
Aiton & Co., Ltd.....84
Allen, W. H., Sons & Co., Ltd. 97
Allspeeds, Ltd.....12
Amal, Ltd.....87
Anderson, C. F., & Son, Ltd....101
Archdale, J., & Co., Ltd.....28
Armstrong Patents Co., Ltd... 90
Arrol, Sir William & Co., Ltd. 42
Associated Electrical Industries, Ltd.....62-88-121
Autometric Pumps, Ltd.....22
Automotive Products, Ltd.....102

B. A. Holland Engineering Co., Ltd.....21
B.T.R. Industries, Ltd.....22
Bagnall, W. G., Ltd.....21
Bailey, Sir W. H., & Co., Ltd... 35
Barnet Metal Co., Ltd.....87
Barron, W. S., & Son, Ltd.....91
Black, Martin, & Co. (Wire Ropes), Ltd.....20
Blackwell Bearings, Ltd.....114
Blakeborough, J., & Sons, Ltd. 45
Booth, Joseph, & Bros.....80
Borg & Beck, Ltd.....94
Braybead (Ascot), Ltd.....124
Bristol Siddeley Engines, Ltd.. 85
British Appliances Mfg. Co., Ltd.....47
British Electrical Development Association 71
British Electrical Repairs, Ltd. 36
British Industrial Engineering Co. (Staffs.), Ltd.....16
British Jeffrey-Diamond, Ltd..123
British Monorail, Ltd.....40
British Steam Specialties, Ltd.. 18
British Steel Founders Association.....83
Brooks Ventilation Units, Ltd. 11

PAGE

British Steel Piling Co., Ltd. Cover i
Brown, David, Corporation (Sales), Ltd.....65
Brown, N. C., Ltd.....26
Brownlie & Murray, Ltd.....102
Buckau, R. Wolf.....37
Bullers, Ltd.....99
Bullows, Alfred, & Sons, Ltd...135
Butcher, Henry, & Co.....133

C. & M. Engineering Co., Ltd..102
Carter, B. & F., & Co., Ltd.... 22
Carter, Horseley (Engineers), Ltd.....117
Cast Basalt Products, Ltd..... 82
Caston Barber, Ltd.....70
Ciba (A.R.L.), Ltd.....66
Clarkson (Engineers), Ltd.....108
Clyde Crane & Booth, Ltd..... 80
Clyde Crane & Engineering Co. 80
Colt Ventilation, Ltd..... 3
Consett Iron Co., Ltd..... 69
Conveyor & Elevator Co. (1936), Ltd.....17
Coventry Climax Engines, Ltd. 72
Crane, Ltd.....73
Crofts (Engineers), Ltd..... 32
Cross Manufacturing Co. (1938), Ltd.....101
Cull, W. B., & Sons, Ltd..... 17

Darlington Forge, Ltd.....107
Dillon's University Bookshop, Ltd.....127
Dixon, W. H.....110
Dobbie McInnes, Ltd..... 38
Dowty Hydraulic Units, Ltd.... 63
Drummond-Asquith, Ltd..... 55

Electrical Power Engineering Co. (B'ham), Ltd..... 77
Electronic Engineering.....127
Entwisle & Gass, Ltd..... 14

Falk Stadelmann & Co., Ltd... 51

PAGE

Farmer, Leopold, & Sons.....133
Fawcett Preston & Co., Ltd....106
Fenner, J. H., & Co., Ltd.....118
Ferranti, Ltd.....105
Filton, Ltd.....53
Firth-Vickers Stainless Steels, Ltd.....34
Fleming & Furguson, Ltd.....101
Foord, John, & Co.....133
Fordsmith, H., Ltd.....18
Forster, T. S., & Sons, Ltd.....102
Foyles.....87
Frank, Charles.....17
Fuller, Horsey, Sons & Cassell..133

Gas Council.....Cover vi
General Descaling Co., Ltd..... 61
Gibson, A. L., & Co., Ltd..... 6
Gibson, John, & Son, Ltd..... 36
Girdlestone Pumps, Ltd..... 70
Goodwin, R., & Sons (Engineers), Ltd.....36

Hall, J. & E., Ltd.....33
Harlow, R., & Son, Ltd..... 78
Harris-Walton Lifting Gear, Ltd.....98
Harvey, G. A., & Co. (London), Ltd.....81
Harvey & Longstaffe, Ltd..... 77
Head Wrightson Machine Co., Ltd.....48-49
Herbert, A., Ltd.....50
Higgs Motors, Ltd.....8
Hills (West Bromwich), Ltd.... 54
Hird-Brown, Ltd.....67
Hoffman Manufacturing Co., Ltd.....Cover v
Holmes, W. C., & Co., Ltd....115
Holst & Co., Ltd.....Cover v
Horne Engineering Co., Ltd....132
Horseley Bridge & Thomas Piggott, Ltd.....117
Horseley-Piggott (Water Engineers), Ltd.....117
Hot Dip Galvanizers Association.....56

PAGE

Hyde, R., Castings.....111

Imperial Chemical Industries, Ltd.....52
Ince Forge Co., Ltd.....110
Ironsides Lubricants, Ltd..... 36

Jellyman, S., Ltd.....91
Jenks Bros., Ltd.....53

Keith Blackman, Ltd.....79
Kempe's Engineers Year-Book 127
Kingswinford Engineering Co., Ltd.....47

Lambert Engineering Co. (Glasgow), Ltd.....54
Lanarkshire Bolt & Rivet Co., Ltd.....112
Leeds Engineering & Hydraulic Co., Ltd.....87
Lintott, H. & E., Ltd.....68
Little, J. H. (Traction and Engineering), Ltd.....38
London Electric Firm, Ltd.....123
Lynch, M. & Son, Ltd.....39
Lyon, Arthur, & Co. (Engineers), Ltd.....44

MacLellan, P. & W., Ltd..... 57
McNair, D. G., & Co., Ltd..... 25
Marconi Instruments, Ltd..... 76
Marinite 23
Marley, W. H., & Co., Ltd..... 91
Marshall, T., & Son, Ltd..... 15
Maxseal Valves, Ltd.....110
Metallic Valve Co., Ltd.....116
Micanite & Insulators Co., Ltd. 67
Morgan Refractories, Ltd..... 13
Morris, B. O., Ltd.....104
Morris, Herbert, Ltd..... 96
Motor Gear & Engineering Co., Ltd.....106
Mountford, John, & Co., Ltd.. 99

National Coal Board.....74-75
Neill, Wm. & Son (St. Helens), Ltd. 73

PAGE

Newall Group Sales, Ltd.....113
Newbury Diesel Co., Ltd..... 18
Newton Collins Ltd.....50
Normand Electrical Co., Ltd.... 53
North British Locomotive Co., Ltd. 27

Parker, F., Ltd.....124
Permutit Co., Ltd.....30-31
Philips Electrical, Ltd..... 58
Phillips, B. L., & N., Ltd..... 14
Plenty & Son, Ltd..... 5
Pollard, F., & Co., Ltd.....132
Pool, J. & F., Ltd..... 25
Power-Gas Corporation, Ltd.... 9
Prestons, Ltd.....15
Price, J. T., & Co., Ltd.....117
Priest Furnaces, Ltd.....102

Qualter Hall & Co., Ltd..... 29

Ratcliffe, F. S. (Rochdale), Ltd. 38
Renold Chains, Ltd.....120
Renshaw Foundry, Ltd..... 77
Reynolds Tube Co., Ltd. 112
Richardson, Westgarth & Co., Ltd. 134
Ritherdon & Co., Ltd..... 78
Roberts Bros. 22
Rocol, Ltd.....86
Rubber-By-Products (Warwickshire), Ltd.....17

Sale, H. B., Ltd.....78
Schieldrop & Co., Ltd..... 22
Scottish Aviation.....132
Semtex, Ltd.....89
Shaw, J., & Sons (Salford), Ltd.103
Sheepbridge Equipment, Ltd.... 67
Shipham & Co., Ltd.....57
Simmonds Aerocessories, Ltd.... 46
Simons-Lobnitz, Ltd..... 7
Simplifix Couplings, Ltd..... 7
Sinex Engineering Co., Ltd..... 24
Slingsby, W., & Co., Ltd..... 21
Smedley Bros., Ltd..... 47

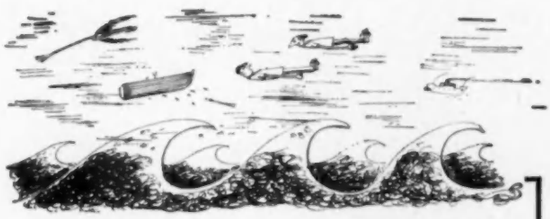
PAGE

Smethwick Drop Forgings, Ltd. 41
Smith & McLean, Ltd..... 99
Smiths Industrial Instrument Division 112
Sparklets, Ltd.....59
Staedtler, J. S., Ltd..... 2
Stainless Steel Pumps.....98
Stainless Steel Wire Co., Ltd.... 39
Steel Construction Co., Ltd.....119
Steel Stampings, Ltd.....26
Steele & Cowlishaw, Ltd..... 6
Sterling Metals, Ltd.....25
Sterling-Safway 10
Strachan & Henshaw, Ltd..... 64
Sulzer Bros. (London), Ltd..... 95
Sunbeam Anti-Corrosives, Ltd. 35
Sutcliffe Hydraulics, Ltd..... 68

Taylor Stoker Co., Ltd..... 19
Tecalemit, Ltd.....4
Technical Applications, Ltd..... 26
Technoimpex 38
Thornton, B., Ltd.....92
Thornycroft, John I., & Co., Ltd.....6
Tinsley, H., & Co., Ltd.....39
Tonks, John & Co., Ltd.....132
Tudor Shearing Co., Ltd..... 25
Turner Bros. Asbestos Co., Ltd. 18

Vandervelde, L., Ltd..... 25
Vaughan Associates, Ltd..... 47

Wallsend Slipway & Engineering Co., Ltd.....122
Ward, Thos. W., Ltd.....43-132
Weathershields, Ltd.....35
Weir, G. & J., Ltd.....109
Welsh Metal Industries, Ltd.... 60
Weston Works (Birmingham), Ltd. 15
Westwood Dawes & Co., Ltd.... 93
Wheatley Kirk, Price & Co.....133
Wickman, Ltd.....100
Wiggin, H., & Co., Ltd.....136
Worcester Valve Co., Ltd..... 70



This is nothing to what goes on inside a—

BULLOWS NOPUMP
SPRAY BOOTH

NO CLEANING OUT AFTER 1 YEAR'S CONTINUOUS DOUBLE-SHIFT WORK AT

Massey-Ferguson

(UNITED KINGDOM) LTD · STRETFORD · MANCHESTER

This Booth was started up on production on 1st March, 1959, and has operated two nine-hour shifts on continuous painting of agricultural machinery. When last examined, there was an average depth of silt of 6 inches over the entire water tank bottom, an area of 290 sq. feet. A further 4 inches, making 10 inches in all, can be accommodated before cleaning is essential. After 1 year's operation, the fan and ducting were barely discoloured, the only maintenance cost being cleaning the floor inside the booth, routine greasing of bearings and similar preventive maintenance.

ALMOST ENTIRELY ELIMINATES MAINTENANCE

NO PUMP
NO FILTERS
NO PIPES
NO NOZZLES

In this new type of Water-Wash Spray Booth the exhaust air travels at very high velocity over the water surface entraining water. The air/water mixture, moving through controlled changes of direction, provides the scrubbing action.

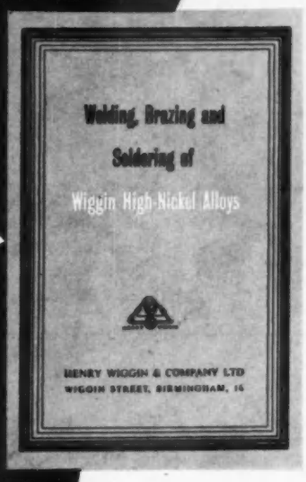
★ **A NEW PATENTED PROCESS OF WATER TREATMENT...** substantially increases the efficiency of these Booths.

Visits to Factories where Bullows' NOPUMP Spray Booths have been installed can be arranged on request. Write today for full details of this outstanding Bullows' achievement.

A. BULLOWS & SONS LTD · LONG ST · WALSALL · STAFFS · Tel 27251

Enter No. 1351 on reply card

WELDING BRAZING AND SOLDERING OF WIGGIN HIGH-NICKEL ALLOYS



This handbook is essential

Send for your copy now

This new 86-page publication provides you with the most up-to-date data for guidance in joining Wiggin High-Nickel Alloys:—Oxy-acetylene, Metal-arc, Argon-arc, Resistance and Flash-butt welding. It also contains sections dealing with the welding of dissimilar metals and on the lining of vessels.

To: Henry Wiggin & Company Limited, Wiggin Street, Birmingham 16
Please send me without charge a copy of your new publication :—

'WELDING, BRAZING AND SOLDERING OF WIGGIN HIGH-NICKEL ALLOYS'

NAME _____

APPOINTMENT OR DEPT. _____

COMPANY AND ADDRESS _____

_____ E/M33/12

HENRY WIGGIN & COMPANY LIMITED, WIGGIN STREET, BIRMINGHAM 16

Enter No. 1361 on reply card

PRINTED BY EDEN FISHER (SOUTHEND) LTD., SOUTHEND-ON-SEA, ESSEX, FOR THE PROPRIETORS, MORGAN BROTHERS (PUBLISHERS) LTD., 28, ESSEX STREET, STRAND, LONDON, W.C.2. 7/10/60

KNOW YOUR BEARINGS

Apprentices
Draughtsmen
Designers
Production Engineers
Purchasing Officers

No. 4
The Duplex Bearing

The forerunner of this bearing was the fifty-years-old Hoffmann four-point contact bearing. The likeness will be seen by comparing the sketches below.

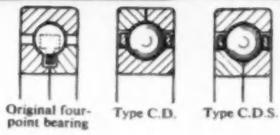
The duplex bearing is really an angular contact bearing designed to carry thrust load in either direction, or combined journal and thrust loads, provided the thrust load is always appreciably greater.

It is supplied with a split outer (type C.D.) or split inner race (type C.D.S.). The former pattern permits the inclusion of a larger number of balls in most cases.

Both patterns may be supplied also for location duty, i.e. slightly smaller on their outside diameters.

HOFFMANN

Manufacturers of precision ball and roller bearings established 1898

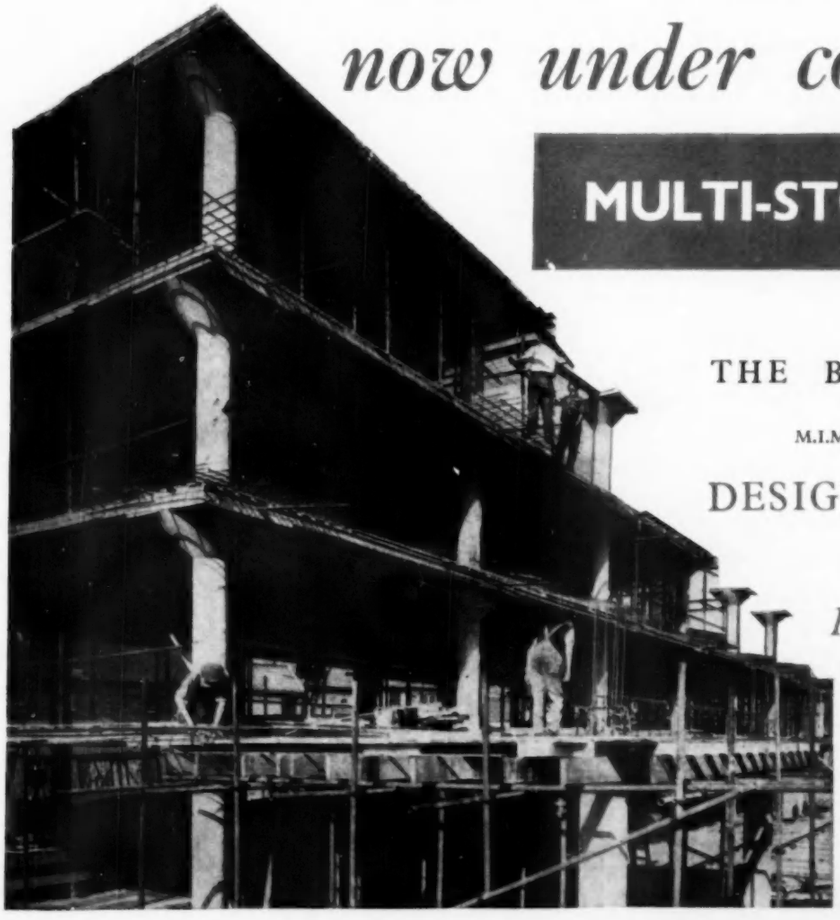


HOFFMANN DUPLEX BEARINGS are made in the following series:-
IN INCH SIZES—LIGHT AND MEDIUM
IN METRIC SIZES—LIGHT, MEDIUM AND HEAVY

THE HOFFMANN MANUFACTURING CO. LTD · CHELMSFORD · ESSEX
TELEPHONE: 3151 TELEX No. 1951

Enter No. C51 on reply card

now under construction



MULTI-STOREY CAR PARK

for

THE BOROUGH OF BEDFORD

F. W. Dawkes, B.Sc.(Eng)., A.M.I.C.E.
M.I.Mun.E., A.M.T.P.I., Borough Engineer & Surveyor

DESIGN & CONSTRUCTION

of the

Reinforced Concrete Structure

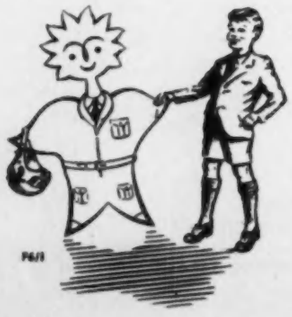
BRANCHES

BIRMINGHAM
MANCHESTER
LEEDS
DURHAM
EDINBURGH
CARDIFF

HOLST
46, CLARENDON RD.,
WATFORD.
TELEPHONE WATFORD 34481

Enter No. C52 on reply card

...backed by MR. THERM who Burns to Serve industry always...



...in all ways. Today, hovercraft and satellites—what of tomorrow? He will grow up with Mr. Therm, for each advance made by Engineers and Technologists will be helped by the unceasing research of the Gas Industry into gas utilisation. Through the twelve Area Gas Boards, the Gas Industry offers an unrivalled free technical advisory service on fuel to the many industries and trades which it serves.

Write or 'phone your problem to your Gas Board NOW

ISSUED BY THE GAS COUNCIL